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Risk Environment in Northern Sea Route Transportation Projects

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Abstract

The need for defining the risk environment in the Arctic strengthens as changing ice conditions and economic opportunities drive the demand for expanding traffic volumes in Russia's Northern Sea Route (NSR). An international commercial shipping route, the NSR is proven to cut transit time up to forty percent compared to the overflowing Suez Canal when traveling from ports in Western Europe to Southeast Asia. The NSR offers a challenging yet attractive project landscape since its opening to global logistics companies in the 1990s. A total of 27 international shipments were made and 1.35 million tons of cargo were moved in 2013. By 2020, cargo volumes shipped along the route are expected to reach 15 million tons per year. With Asian markets pursuing liquefied natural gas from global exporters and large scale exploration and production projects being developed in Northwestern Siberia, the future of the NSR is promising. Compared to other shipping routes, there are unique operational risks for NSR maritime transportation projects; these risks can significantly affect project success. Limited information exists to sufficiently describe risk exposure. This research paper identifies and describes risk factors affecting planning and execution of maritime transportation projects in the Northern Sea Route region based on a review of existing literature and interviews with subject matter experts. Findings are summarized in a descriptive narrative supported by a risk factor breakdown structure. The final project deliverables will be offered to shipping companies and Arctic research organizations to help identify and assess risks for NSR maritime transportation projects.

Key words: Northern Sea Route, Arctic shipping, maritime logistics, risk management, maritime transportation, maritime shipping

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Executive Summary

This risk identification and characterization project explores and defines risk factors affecting planning and execution of maritime transits along the Northern Sea Route. The risk factors were studied from the standpoint of a non-Russian shipping company planning a commercial transit through the Northern Sea Route from the west gates of the Kara Sea and its finish in the Bering Sea, respectively. The focus of this risk categorization project was not to discuss the economics and feasibility of shipping operations through the Northern Sea Route, but rather identify operational risk factors from a project management perspective. Transits through the NSR today justify the prudent implementation of a project environment, given the experimental nature of a large number of transits, and the uncertain conditions under which transits are planned and executed. As opposed to realized risks and hazards, risk factors are the root causes and circumstances that may or may not develop into risks. Every shipping project has its own unique challenges, but the nature of risks in this part of the Arctic offshore is constrained to a specific set of factors produced by a unique permutation of existing environmental, regulatory and economic conditions.

The findings formally address the following questions:

- What are the unique challenges of executing maritime transportation projects in this region?
- What risk factors are or should be addressed by shipping companies when planning a transit?
- What risk factors contribute to enhanced realism and adaptations in project scope, schedule and cost estimates?

The research was based on semi-structured, two-tiered interviews with subject matter experts on Arctic maritime transportation. Literature was reviewed with regard to project risk management practices, maritime shipping, the history of the Northern Sea Route and completed international transits. Findings are described by source and probability/impact categories. A breakdown structure provides a summarized view of identified risk factors. The risk environment for maritime transportation in this area of the Arctic is characterized by a set of risk factors:

- High operational costs
- Search and rescue delays
- Oil spill
- Vessel grounding
- Schedule disruptions
- Vessel damage by collision
- Vessel damage by ice compression
- Vessel damage by unexpected coastline
- Machinery seize-up, loss of propulsion caused by ice
- Costly insurance
- Fog/low visibility
- Unstable weather conditions
- Lack of meteorological, search & rescue, vessel tracking systems and infrastructure
- Strong, variable winds
- Human health and safety
- Communication difficulties
- Solar/magnetic interference phenomena
- Costly Arctic expertise

The aforementioned risk factors may or may not develop into risks in any given international transit. When they do, the likely consequences have significant implications on three project constraints: cost, schedule and scope. Shipping organizations rely on internal risk management practices and support from the NSR Administration during planning and execution to identify and mitigate risks. As infrastructure develops onshore and multi-year ice coverage continues to recede, the severity of risk probability and impact may also diminish allowing safer and more reliable maritime traffic conditions.

Glossary of Terms

AMSA – the Arctic Marine Shipping Assessment is a 2009 report on current issues and future outlook of the Arctic marine traffic developed by the *Protection of Arctic Marine Environment (PAME)* working group of the Arctic Council

Breakdown structure – visual decomposition of a hierarchical structure to smaller parts

Cabotage - transit type that ships goods along the route (i.e., for community resupply) or services a particular project site

Classification society – non-governmental institution that develops and overlooks standards rules for vessels and crew (Bruno, n.d.)

Destinational transits – delivery of bulk cargos from an Arctic region to a non-Arctic region, i.e., iron ore from Murmansk to China; or transits for the purposes of performing some activity in the Arctic, such as research (AMSA, 2009)

Dry bulk cargo – loose cargo, typically grains, metals, other substances which cannot be transported in packages ("Definition of: Dry Bulk Cargo", n.d.)

General cargo – packaged cargo, typically merchandise

IMO – International Maritime Organization, a specialized UN body that establishes and maintains the regulatory framework governing all maritime shipping

LNG – liquefied natural gas

Liquid bulk cargo – typically oil and gas products, or other liquid substances shipped in tankers

Multi-year ice – sea ice coverage older than one year, requires icebreaking capabilities

NSR – Northern Sea Route

Project – a temporary unique endeavor undertaken to achieve a specific end goal according to scope, schedule and cost specifications

Project management – the application of knowledge to project activities to meet project goals (PMI, 2008)

Protection & Indemnity (P&I) – marine liability coverage that protects against damage to the hull, non-delivery of cargo and other common shipping risks

Risk – an uncertain event or condition that, if it occurs, has a positive or negative effect on project objectives (PMI, 2009)

SAR – Search and Rescue

SOLAS – the International Convention on Safety of Life at Sea of 1965 dictates minimum safety standards for vessel construction and operations. Developed by the International Maritime Organization (IMO)

UNCLOS – United Nations Convention on the Law of the Sea

VTS – Vessel Tracking System

Introduction

In the last fifty years the extent and thickness of sea ice coverage in the Arctic has receded enough to allow regular seasonal navigation along Russia's Northern Sea Route, and regulatory changes have welcomed international operators. A shipping route from Western Russia to the Bering Strait, the NSR can be used to link Scandinavia and Western Europe with the Asia Pacific region. Incentives in the form of costs and time savings for intercontinental transits elevated the route's potential to become a priority shipping lane. Its future value as a maritime route depends upon new investment and renovation of coastal infrastructure, as well as the maritime shipping industry's understanding and management of risk in the Arctic offshore. In terms of risk exposure, the Northern Sea Route is a familiar environment to the Russian maritime industry, but an uncertain new terrain for foreign shippers because open information does not exist or is very limited given the route's short history of international transits. Since 2009, seasonal navigation consisting of cabotage and destinational transits has been increasing. It is expected that this growth will continue as more shippers take advantage of the route's time savings, and more baseline data on risk exposure is produced. The risk landscape in the NSR is shaped largely by Arctic offshore conditions, technological constraints, and tight federal regulatory requirements. Understanding local risk conditions is critical to balancing environmental concerns, ensuring human safety, and supporting economic development in the circumpolar region. This research is an attempt to understand the dynamics of the route's risk environment and its unique challenges as it pertains to the maritime industry's current and future use.

Scope of Research

This risk identification and characterization project explores and defines risk factors affecting planning and execution of maritime transits along the Northern Sea Route. The risk factors were studied from the standpoint of a non-Russian shipping company planning a commercial transit through the Northern Sea Route from the west gates of the Kara Sea and its finish in the Bering Sea, respectively. The focus of this risk categorization project was not to discuss the economics and feasibility of shipping operations through the Northern Sea Route, but rather identify operational risk factors from a project management perspective. Transits through the NSR today justify the prudent implementation of a project environment, given the experimental nature of a large number of transits, and the uncertain conditions under which transits are planned and executed. As opposed to realized risks and hazards, risk factors are the root causes and circumstances that may or may not develop into risks. Every shipping project has its own unique challenges, but the nature of risks in this part of the Arctic offshore is constrained to a specific set of factors produced by a unique permutation of existing environmental, regulatory and economic conditions.

The findings formally address the following questions:

- What are the unique challenges of executing maritime transportation projects in this region?
- What risk factors are or should be addressed by shipping companies when planning a transit?
- What risk factors contribute to enhanced realism and adaptations in project scope, schedule and cost estimates?

The research was based primarily on interviews with experts on Arctic maritime transportation. Additional literature was reviewed with regard to project risk management practices, maritime shipping, the history of the Northern Sea Route and completed international transits. Findings are described by source and probability/impact category. A breakdown structure provides a summarized view of identified risk factors.

Literature Review

The literature search focused on providing a background in Arctic maritime transportation, the history and current state of the Northern Sea Route, large-scale exploration and production projects benefitting from the Northern Sea Route as their primary transportation route, and its comparison to the Suez Canal. Literature sources include:

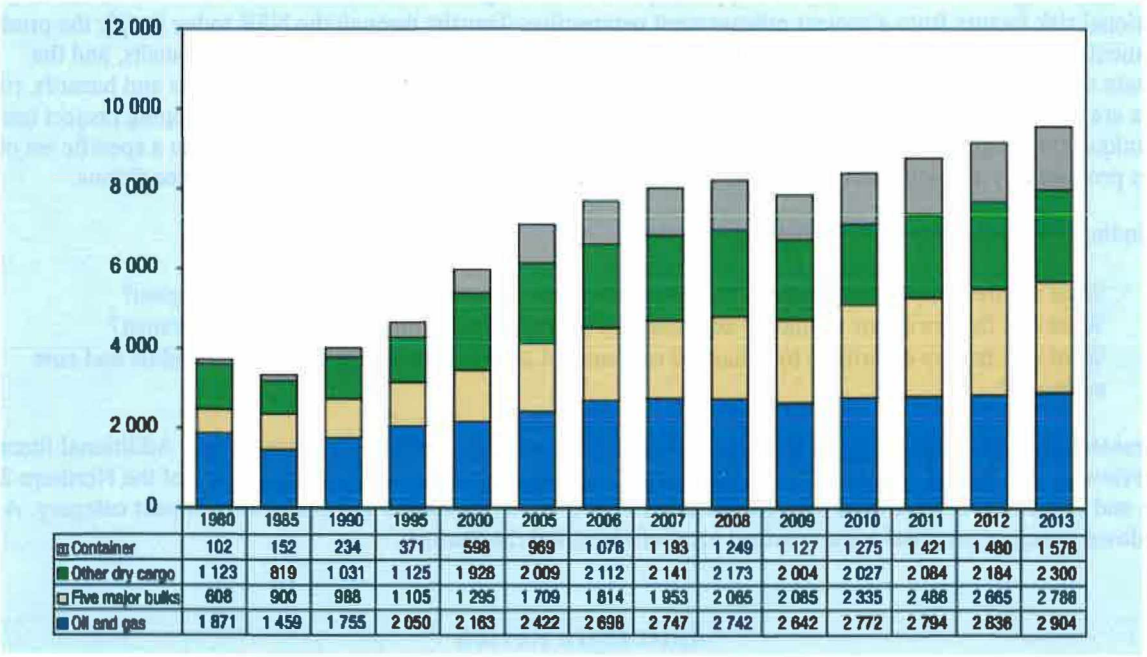
Arctic Marine Shipping Assessment (AMSA), Arctic Council, 2009
Arctic Opening: Opportunity and Risk in the High North, Lloyd's, 2012
Arctic Resources and Transportation Information System, Centre for High North Logistics

Demystifying the Arctic, World Economic Forum Global Agenda Council on the Arctic, 2014
Navigating the Northern Sea Route: Status and Guidance, American Bureau of Shipping, 2014
NSR Transit Statistics, The Northern Sea Route Information Office, 2011-2013
Review of Maritime Transport, United Nations Conference on Trade and Development, 2012
The Arctic – the Next Risk Frontier, Det Norske Veritas GL, 2014
The Future of Arctic Shipping: A New Silk Road for China?, Arctic Institute, 2013
Working papers, The International Northern Sea Route Programme (INSROP), 1993-1999

Other sources consist of peer-reviewed journals, textbooks, and industry reports on the Northern Sea Route, Arctic development, and risk management.

Arctic Maritime Transportation and the Northern Sea Route

According to Panitchpakdi (2012), "Maritime shipping is the backbone of international trade and a key engine driving globalization. Around 80 percent of global trade by volume and 70 percent by value is carried by sea and handled by ports worldwide." Global seaborne trade has been developing steadily since the second half of the 20th century, driving the movement of goods between continents as seen in Exhibit 1. Most of the world's trade in containerized products is confined to the northern hemisphere, and to traffic between North America, Europe and Asia (Knowles, Shaw, and Docherty, 2008). This fact explains the preeminence of two main maritime corridors: the Suez and Panama canals connect maritime transportation routes and support global supply chains. The "Royal Road" through the Suez Canal serves nearly all of the Asia-Europe market and 46 percent of vessels transiting are container ships (Verny & Grigentin, 2009). With new technological advances in shipbuilding, vessel sizes and maximum capacities will only increase in the future leading to congestion in the Suez Canal and potential delays in transit schedules causing costly consequences for supply chain stakeholders, as just-in-time management frameworks require secure and prompt delivery (Blunden, 2012).



	1980	1985	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013
Container	102	152	234	371	598	969	1 076	1 193	1 249	1 127	1 275	1 421	1 480	1 578
Other dry cargo	1 123	819	1 031	1 125	1 928	2 009	2 112	2 141	2 173	2 004	2 027	2 084	2 184	2 300
Five major bulks	608	900	988	1 105	1 295	1 709	1 814	1 953	2 065	2 085	2 335	2 486	2 665	2 786
Oil and gas	1 871	1 459	1 755	2 050	2 163	2 422	2 698	2 747	2 742	2 642	2 772	2 794	2 836	2 904

Exhibit 1. International seaborne trade, selected years in millions of tons loaded (five major bulks: iron ore, grain, coal, bauxite/alumina and phosphate rock) (UNCTAD, 2013)

Shipping & Transportation Modes

Three main modes of shipping services exist: liner, tramp and industrial shipping. Liner shipping involves moving general and container cargo according to a published schedule. Tramp ships are usually cargo carriers or tankers that follow the available cargo, often times under short-term contractual agreements (Christiansen, Fagerholt, Nygreen, Ronen, 2007). Industrial operators, typically oil, gas or mining companies, own and operate their fleets and cargo. According to the Arctic Council's Arctic Marine Shipping Assessment (2009), nearly all transportation in the Arctic today is destinational, consisting of community resupply, transport of natural resources, marine tourism, etc. Highest activity occurs along the coast of northwest Russia and in the ice-free waters off Norway, Greenland, Iceland and in the US Transportation activity in the Arctic is constrained by navigational seasons, except for parts of Norway and Northwestern Russia where little or no ice in the winter months enables year-round operations. The Northern Sea Route and the Northwest Passage are seasonal routes where marine navigation only occurs during summer and fall months. As Arctic infrastructure develops, destinational shipping will remain the prevailing transportation mode. Other modes of transportation include cabotage - servicing a specific area with project cargo, as in the example with Norilsk Nickel where the ships operate between ports of a single Arctic state. Intra-Arctic transport links two or more Arctic states; i.e., barge traffic operating between Canadian Northwest Territories and the Alaskan Coast (AMSA, 2009). Trans-Arctic navigation, also called 'ocean to ocean', uses the Arctic as a marine link between the Pacific and Atlantic oceans.

Arctic Marine Transportation Regulatory Environment

Comprehensive regulatory frameworks concerning Arctic marine transportation are still largely under development. The United Nations Convention on the Law of the Sea (UNCLOS) of 1982 is the main legal framework according to which nation-states regulate shipping within their maritime zones of jurisdiction (AMSA, 2009). Canada and Russia have developed their own legislation in addition to the UNCLOS that set out regulations specific to shipping in ice-covered waters. While "UNCLOS allows coastal states to adopt regulations applicable to foreign ships transiting through their territorial seas, coastal states cannot impose design, construction, crewing or equipment standards unless giving effect to generally accepted international rules or standards" (AMSA, 2009). The International Maritime Organization (IMO), a specialized UN agency, provides non-mandatory industry recommendations concerning standards and best practices pertaining to international shipping through their 2002 *Guidelines for Ships Operating in Arctic Ice-covered Waters* (AMSA, 2009). Mandatory safety standards are stipulated in the International Convention on Safety of Life at Sea (SOLAS) of 1974. SOLAS specifies minimum safety standards for construction, machinery and equipment, and flag states are required to certify against these requirements. Most recently the IMO has approved a draft of the mandatory International Code of safety for ships operating in polar waters (Polar Code) and will soon review a new SOLAS chapter that will make the first part of the Polar Code mandatory. According to the IMO (2014), the code will provide "design, construction, equipment, operational, training, search and rescue and environmental protection matters relevant to ships operating in the inhospitable waters surrounding the two poles". Other stakeholders that dictate the way transport in the Arctic occurs may include port authorities, shipowners and cargo owners.

Advantages of Using the Northern Sea Route

The current state of the Northern Sea Route does not allow it to compete with the Suez Canal as an alternative trading route, but it does provide certain advantages. Three main factors favor the use of an alternative shipping route such as the Northern Sea Route to support seasonal Europe - Asia transportation:

- Increasing capacity constraints in the Suez Canal complicated by political instability in the region and potential safety risks result in cost overruns and schedule irregularities.
- A longer navigational season along the northern coast of Russia and the reduction in multi-year ice provides extended access to the NSR for more types of vessels, thus resulting in less costly operations.
- The Northern Sea Route provides up to 40% savings in transit time when travelling from ports in Europe to ports in China, Korea and Japan.

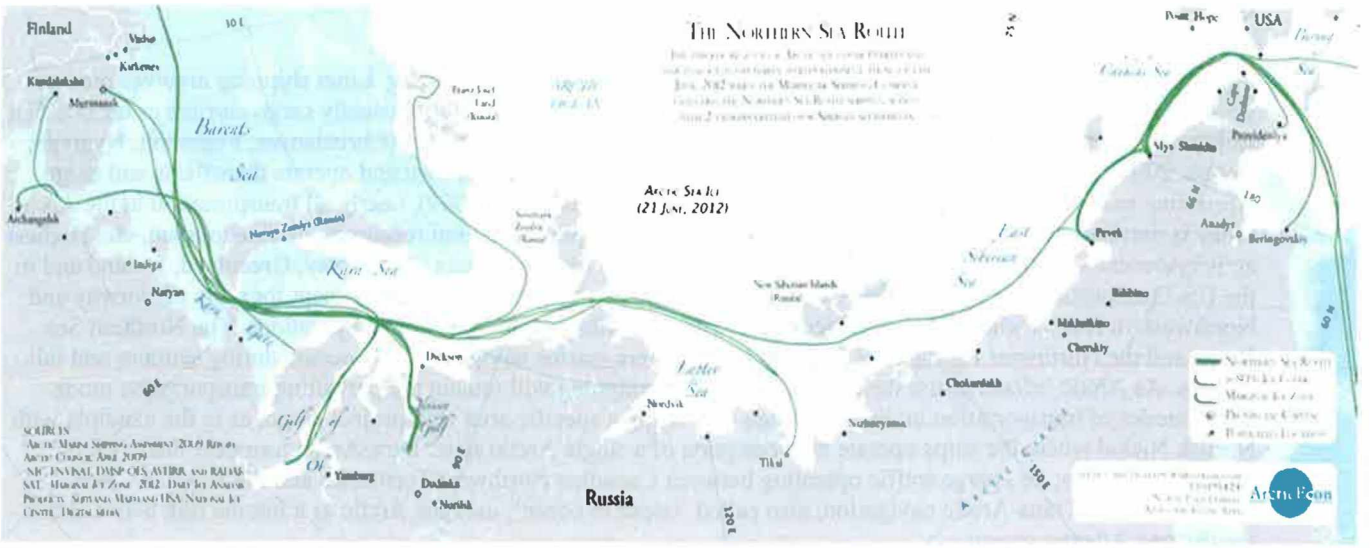


Exhibit 2. The Northern Sea Route (ArcticEcon, 2012)

History of the Northern Sea Route

The Northern Sea Route is defined by the waterway between the Kara Strait or the Kara Gates between the southern coast of the Novaya Zemlya Islands and the northern tip of the Vaygach Islands where the Barents Sea links to the Kara Sea, and the Cape of Provideniya (Providence Bay) in the Bering Strait. It connects five Arctic seas and overlaps four, starting at the western edge of the Kara Sea, overlapping the Laptev, East-Siberian, Chukchi seas, and finishing in the Bering Sea, as shown in Exhibit 2. The distance of the shipping lane can vary from 2100 to 2900 nautical miles depending on the routing (Liu & Kronback, 2010).

Parts of the Northern Sea Route have been navigated and studied for several centuries by European and Russian sailors. In his work *The Northern Sea Route* (1950), Trevor Lloyd mentions one of the early voyages along the full length of the route. Captain J. Wiggins' and Baron A.E. Nordenskjöld's expedition in 1878-1879 from Western Europe to the Pacific Ocean was carried out with the goal of developing a trade route between Europe and Siberia. Wiggins subsequently made ten annual trips from Europe to the Ob and Yenisey rivers delivering materials for the construction of the Trans-Siberian Railway (1950). Centuries after that, the seas along the NSR were traversed by brave Arctic pioneers such as Vitus Bering, James Cook, Semyon Dezhnev, Barentsz, Chichagov, Vilkitsky, Nansen, Amundsen, Brusilov, and many others.

According to Granberg (1998), regular domestic transit traffic along the NSR began in 1935. During the Soviet era, the Northern Sea Route was used exclusively for domestic resupply of communities in the Russian North, and sporadic voyages between East Asian countries and northwestern Russia. Transit statistics for the second half of the 20th century are shown in Exhibit 3. It was opened to international operators in 1990 by signing of the 'Regulations for Shipping along the Northern Sea Route" (Granberg, 1998).

	1945	1960	1970	1980	1985	1987	1990
Deliveries to the Arctic from other regions of the USSR (coasting), total incl.:	71.4	349.1	1563	2279.9	2760.6	2943.6	2490.4
From the west	63.9	188.1	932	1418.9	1649.9	1808.1	1355.1
From the east	7.5	161	631	861	1110.7	1135.5	1135.3
Deliveries from the Arctic to other regions of the USSR (coasting)	116.2	113.4	392.7	1292.3	1561.8	1684.7	1556
Intra-arctic coasting	85.4	88	340.7	398.6	411.8	358.6	136.2
Foreign trade shipments incl.:	171.1	412	683.6	980.6	1409	1590.7	1212.8
Export	51.2	412	616.9	888.1	1097.5	1080.9	1281

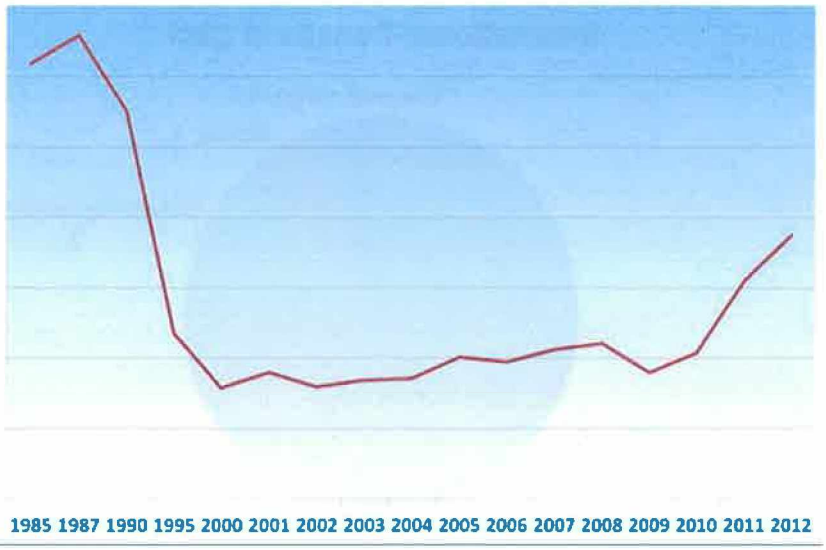


Exhibit 5. Rotterdam to Yokohama (Hugo Ahlenius, 2007)

Official statistics from the Northern Sea Route Information Office (2012) show that starting in 2011 marine activity in the region grew from 41 total transits to 71 in 2013 as shown in Exhibit 6. International transits (Europe to Asia or vice versa, Western Europe to Russian Far East, etc.) accounted for 17 in 2011 and 27 both in 2012, and 2013. All international transits in 2011 were cargo shipments. Out of 10 gas product shipments, 8 were Russian gas products bound for South Korea and China.

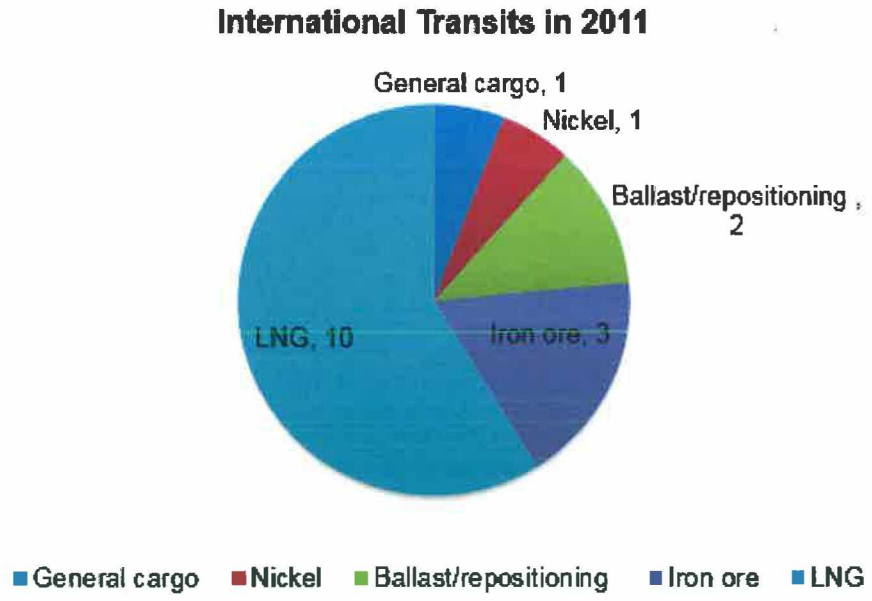


Exhibit 6. International Transits in 2011 (NSR Information Office, 2012)

The preeminence of LNG among cargo types moved along the route is explained by a large demand from North Asian countries, particularly South Korea, Japan and Taiwan as seen in Exhibit 7. While the demand for LNG for is predicted to remain stable, China and other South East Asian countries will require even more supply between now and 2020. Given the development of natural gas fields in the Barents and Kara seas, the NSR will continue to be dominated by LNG shipments.

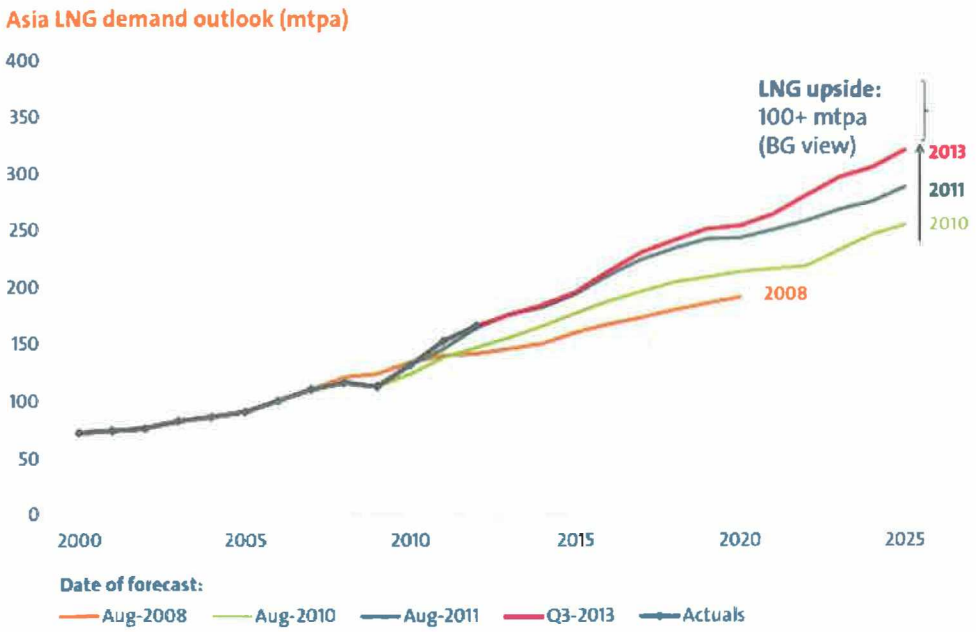


Exhibit 7. Asia LNG Demand (BG Group, 2014)

Activity rose significantly in 2012 with a few trans-Arctic repositional voyages completed in addition to cargo deliveries, as seen in Exhibit 8. This speaks on behalf of the NSR being a convenient maritime corridor to access and link European and Asian ports. A total of 553,260 tons of gas and 243,377 tons of oil products were transported in international liquid bulk cargo shipments that year. 262,263 tons of iron ore and 71,786 tons of coal accounted for mineral resources. Eight out of nine LNG shipments in 2012 belong to the Russian natural gas giant Novatek with transits bound for South Korea (7) and China (1). Nine LNG and four oil product deliveries made liquid bulk cargo the most prominent type of cargo shipped along the NSR in 2012. Three Intra-Arctic voyages that year once delivered dry bulk cargo from Germany to Canada and twice from Denmark to Alaska, USA.

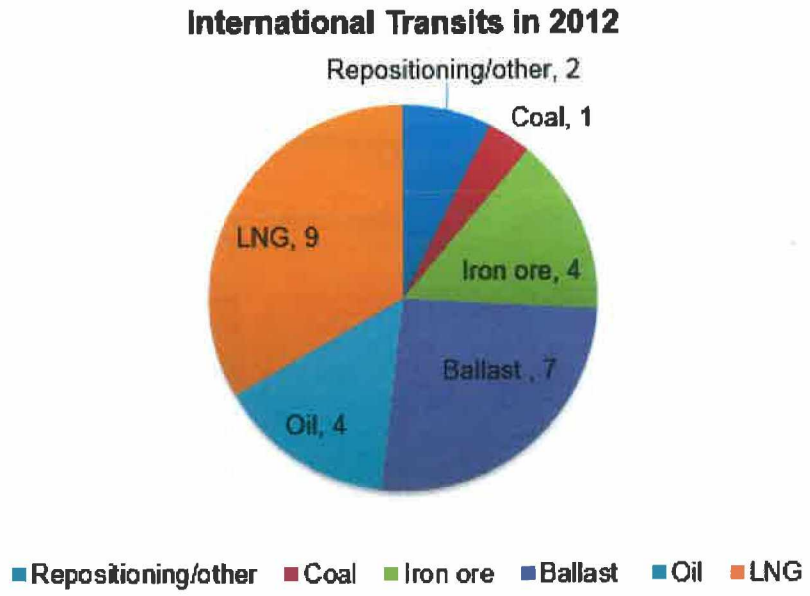


Exhibit 8. International Transits in 2012 (NSR Information Office, 2012)

In 2013 a similar picture prevailed in terms of liquid bulk cargo dominating the NSR shipping industry, as shown in Exhibit 9. Out of ten LNG deliveries, seven were made on behalf of Novatek supplying Asian markets. Two out of the three non-Novatek LNG deliveries were also from Russia and bound to Asia. A single Norwegian shipment of LNG made its way to Japan.

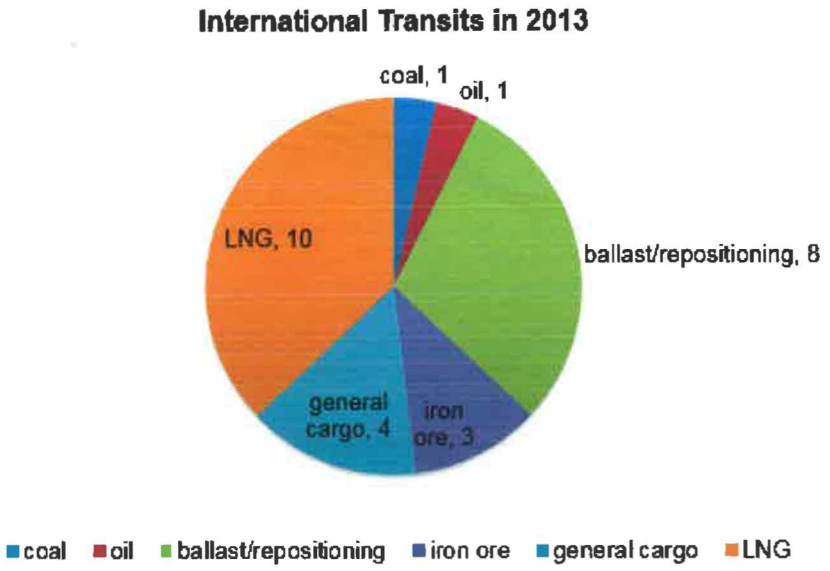


Exhibit 9. International Transits in 2013 (NSR Information Office, 2012)

A total of 692, 982 tons of gas product and only 66,855 tons of jet fuel were shipped that year internationally. Dry bulk cargo (337,030 tons in total) accounted for the rest with general cargo (60,091tons) being the majority in number of transits. These shipments were all strictly Asia to Europe: Vietnam to Poland, South Korea and China to the Netherlands. Three iron ore deliveries were all strictly Murmansk, Russia to China transits. A single shipment from Vancouver, Canada delivered 73,500 tons of coal to Pori, Finland (NSR Administration, 2013). Exhibit 10 depicts the number of transits on the route by country flag in navigational seasons of 2011 and 2012. The majority of vessels bear Russian registrations, followed by Panamian, Finnish and Norwegian flags.

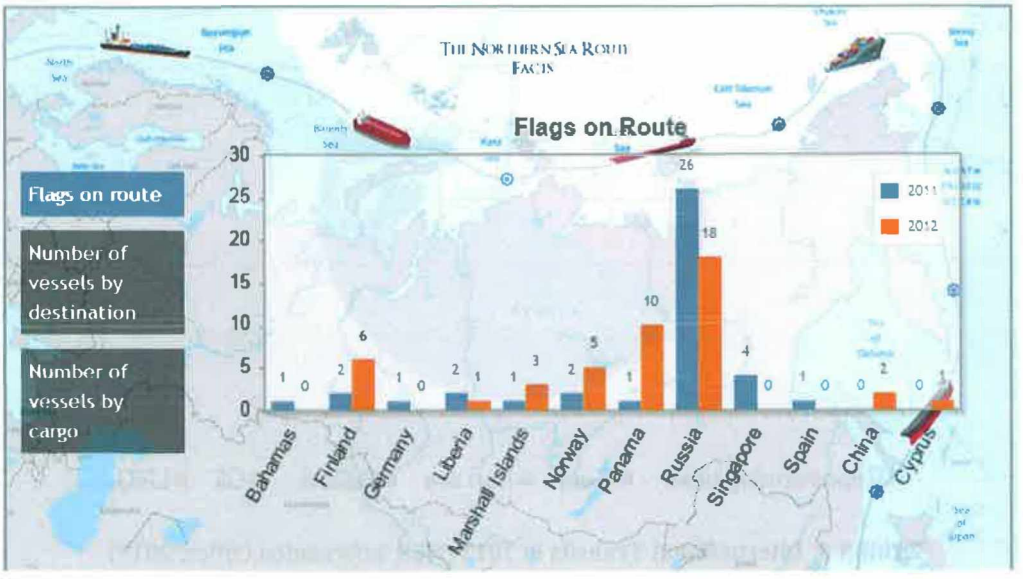


Exhibit 10. Flags on route in 2011 and 2012 (NSR Administration, 2013)

Exhibit 11 shows the top fifteen international transits by tonnage in 2012: almost half of these transits (46%) delivered gas products; a third (27%) accounted for iron ore and 20% for jet fuel. The transits were executed from July to October.

Top 15 full NSR transits in 2012 by tonnage								
Vessel (Flag)	**Shipowner/Operator**	**Cargo type**	**Cargo tonnage**	**Origin**	**Destination**	**Date of sail (dd.mm.yy)**	**Time on NSR (days)**	**Average speed (kn)**
Nordic Odyssey (Panama)	Nordic Bulk Carriers	Coal	71786	Vancouver	Hamburg	26.10.12	20	10.4
Nordic Odyssey (Panama)	Nordic Bulk Carriers	Iron ore	67520	Murmansk	China	10.07.12	11.2	9.7
Marika (Norway)	Marinvest	Jet fuel	66552	Yosu, Korea	Porvoo, Finland	11.08.12	10.2	10.2
Stena Poseidon (Finland)	Neste Oil	Jet fuel	66416	Yosu, Korea	Porvoo, Finland	30.06.12	11.5	9.4
Ob River (Marshall Islands)	Lance Shipping S.A.	LNG	66342	Hammerfest	Tobata, Japan	07.11.12	9	12.5
Palva (Finland)	Neste Oil	Jet fuel	66275	Yosu, Korea	Porvoo, Finland	05.09.12	8.5	11.8
Nordic Odyssey (Panama)	Nordic Bulk Carriers	Iron ore	66000	Murmansk	Huanghua, China	09.09.12	7.4	13.5
›rdic Orion (Panama)	Nordic Bulk Carriers	Iron ore	65937	Murmansk	Huanghua, China	10.08.12	8.5	12.3
Nordic Orion (Panama)	Nordic Bulk Carriers	Iron ore	62806	Murmansk	Huanghua, China	02.10.12	7.5	13.3
STI Harmony (Marshall)	Scorpio Ship Management	Gas condensate	61496	Murmansk	Zhenjiang, China	23.08.12	8.1	12.9
Marika (Norway)	Marinvest	Gas condensate	61266	Murmansk	Korea	30.09.12	8.6	11.6
Maribel (Norway)	Marinvest	Gas condensate	61138	Murmansk	Daesan, Korea	17.10.12	7.8	12.8
Marinor (Norway)	Marinvest	Gas condensate	60992	Murmansk	Daesan, Korea	30.08.12	8.4	12.4
Two Million Ways (Cyprus)	Nagilo shipping Company Ltd	Gas condensate	60841	Murmansk	Incheon, Korea	26.09.12	8	12.5
Marilee (Norway)	Marinvest	Gas condensate	60505	Murmansk	Incheon, Korea	10.07.12	11.3	9.6

Exhibit 11. Top 15 full NSR transits in 2012 by tonnage (Northern Sea Route Information Office, 2013)

Exploration & Production Projects along the Route

As seen in transit statistics from 2010 to 2012, gas products and iron ore are the primary types of cargo moved along the NSR. These cargos are produced by large-scale exploration and production projects in Northwestern Russia.

Destinational transits are those delivering bulk cargo from an Arctic region to a non-Arctic region (i.e., iron ore from Murmansk to China) or for the purposes of performing some activity in the Arctic, such as research (AMSA, 2009). Cabotage is a transit type that ships goods along the route (i.e., for community resupply) or services a particular project site. Yamal LNG is a large-scale oil & gas program on the coast of the Kara Sea. It is estimated that 70% of the world's undiscovered natural gas reserves are located in the Arctic: offshore and onshore the Kara Sea where Yamal LNG is being developed, in the East Barents Basin with the Shtokman field development currently on hold, and the Alaska Arctic (AMSA, 2009).

The Yamal LNG project is a joint venture between Russia's largest independent natural gas producer Novatek with a 60% equity stake, France's Total (20%) and the Chinese National Petroleum Company (20%). According to Novatek (2014), 16.5 million tons of gas will be produced annually by 200 wells and 3 LNG trains. The logistical program includes the construction of a deep sea Arctic port of Sabetta which will service 16 commissioned Arctic class LNG tankers. The first gas shipments are expected in 2017. The ice-strengthened tankers will each be able to transport 170 000 cubic meters of gas, and will be developed by Daewoo Shipbuilding & Marine Engineering. The Arctic Marine Shipping Assessment of 2009 predicted that by 2020 approximately 40 million tons of oil and gas will be shipped annually along the NSR, and it is clear today that Yamal LNG will make the greatest contribution to that number. Cabotage is the type of regional transport that is servicing the construction of Yamal LNG at the moment, and it will remain the main mode of transportation until export operations start. Such a large-scale port and fleet program is undertaken to allow massive exports of LNG products both east in the summertime and west during winter months, as seen in Exhibit 12.

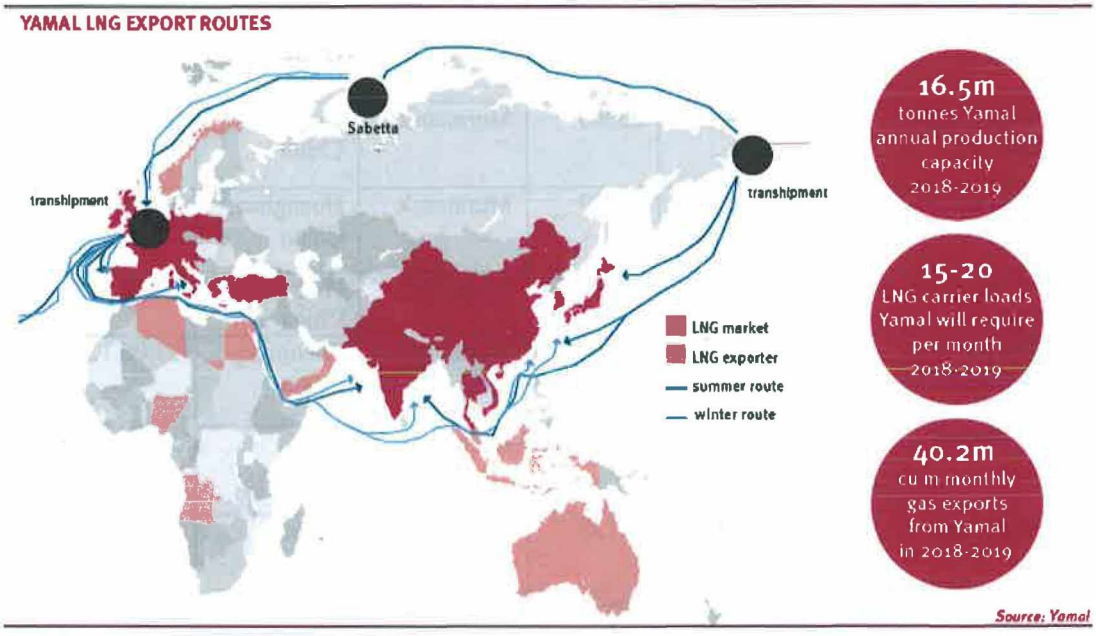


Exhibit 12. Yamal LNG Shipping Options (Renton, 2013)

The world's largest nickel and palladium mine Norilsk Nickel located on the Kola Peninsula also operates a private fleet of container ships with Arctic class icebreaking capacity to supply the mine and transport bulk cargo. The dual-ended or double-acting (DAT) ships turn stern first in ice-covered waters and move backwards when in blue waters. The cabotage operations they participate in are therefore independent of icebreaker assistance. Depending on ice conditions, ships that do not possess icebreaking capabilities require ice pilot and icebreaker assistance along the route. The aforementioned cargo deliveries of iron ore to Asia from Murmansk represent destinational transits. Most of the Barents Sea is ice-free in the summer; however, starting at the entrance to the Northern Sea Route at the Kara Gates, multi-year ice is expected which is why icebreaking assistance represents the most effective risk management practice employed by the Russian government to mitigate any potential emergencies.

Destination	Via Suez Canal			Through the NSR			Days Saved
	Distance, nm	Speed, knots	Days	Distance, nm	Speed knots	Days	
Shanghai, China	12050	14.0	37	6500	12.9	21	-16
Busan Korea	12400	14.0	38	6050	12.9	19.5	-18.5
Yokohama, Japan	12730	14.0	39	5750	12.9	18.5	-20.5

Exhibit 13. Distances and potential days saved for Asian transport from Kirkenes (Norway) and Murmansk (Russia), (Tschudi Shipping Company, 2014)

Disadvantages of Using the Northern Sea Route

While the route delivers reduction in transit time or time at sea (as shown in Exhibit 13) translatable into bulk fuel savings when traveling from Europe to Asia or vice versa, its development as a large-scale supply chain route is not at all a short-term prospect. Major factors complicating development are:

- Seasonal accessibility: the route is only available for transits a few months in a year, typically from July - August to November.
- Costly fees: the Russian government requires icebreaker assistance along with various technical and safety inspections, vessel and cargo insurance, bulk fuel, human resources with Arctic maritime expertise, etc.
- Unreliable schedules due to ice and weather conditions: supply chains and logistical operations require reliable scheduling which is inherently difficult in the Arctic offshore.
- Lack of infrastructure along the route: lack of ports, search and rescue centers, weather and ice or marine traffic tracking systems complicate operational safety and undermine schedule reliability.

These and other factors impact the NSR's ability to compete with the Suez Canal as a major trading route. The future of the Northern Sea Route long-term may change as ice coverage diminishes with time and more infrastructure is placed. Milschus (interview, June 17, 2014) states that this particular Arctic shortcut will remain the primary route for high value project cargoes with restricted transit times that pay premiums, or even liquid products, whereas bulk cargoes are expected to remain on the Suez, unless the cargo is high value or produced in regions linked to the route itself.

Project Risk Management

Transits through the NSR today lend themselves to a structured, mature project management environment given the experimental nature of a large number of transits, and the uncertain conditions under which transits are planned and executed. No two transits are alike which is why for the purposes of this research project conditions and contributing risk factors are assessed from a project management perspective. A project is a unique endeavor with a clear start and finish carried out with the purpose of achieving a specific end goal. The ultimate goal of project management is to reduce risk and increase opportunities.

Risk management is the most critical aspect of conducting projects in the Arctic, particularly where the remoteness, cold climate, and lack of supporting infrastructure requires robust safety practices and unique standards. According to Dobbins (2001), "risk management activities have gained acceptance in the marine transportation industry due to the severe penalties for pollution and spills, environmental protection initiatives of industry associations, and public perception of a company's environmental performance". This research has to do with the risk identification process, as opposed to risk mitigation and control, and delivers identified risk factors as its findings. In the overall risk management framework, risk identification is the first step in risk assessment, which leads to developing a risk management strategy, as seen in Exhibit 14.

Exhibit 14. The Project Risk Management Process ("Project Risk Management – Tools and Techniques", 2011)

The Project Management Body of Knowledge (2009) defines project risk as "an uncertain event or condition that, if it occurs, has a positive or negative effect on project objectives". The shipping organizations interviewed rely on internal risk management processes under the assumption that risks are identifiable and predictable. Different views exist on the risk environment in offshore Arctic resource development which shares or includes common conditions (i.e., environmental, regulatory, etc.) with maritime transportation.

Kaempf (2011) argues that the Arctic offshore is characterized by a risk environment so severely unique and challenging in its technical and social complexity, the entire approach to project risk management processes requires a shift to a new paradigm that utilizes more diverse tools and techniques to combat such inherent complexity as a 'wicked problem'. A 'wicked' project environment is characterized by uniqueness, ever-changing requirements and constraints, and a diverse pool of stakeholders with conflicting views and values. Traditional linear risk management paradigms use quantitative and qualitative tools to predict and assess risks, but tend to fail when encountering 'wicked' problems – complex, unforeseen events with severe damage capacity (the 2010 BP Deepwater Horizon oil spill, in example). It is arguable whether the application of risk management processes to shipping along the NSR may be called a 'wicked problem'. Project conditions for maritime transportation in this area of the Arctic, nevertheless present a highly complex system with uncertainties and gaps in baseline data that is used to predict project outcomes and assess risks, as well as changing regulatory requirements and the existence of technical constraints to proposed solutions. Regardless of theoretical applications, the most advanced and robust risk management practices are required for any type of activities anywhere in the Arctic region.

According to Hagen (interview, June 13, 2014), perceptions of risk in commercial shipping along the NSR are overinflated. The tight control imposed by the NSR administration mitigates most potential for accidents. This view is shared among the shippers interviewed. Ostreng states that according to Russian sources, between 1954-1990 when no foreign ship was allowed to transit the NSR and all operations were done by the Soviet government, recorded incidents averaged 22 per year (a total of 800) with almost half occurring in the most busy area, the Kara Sea (49%); 20% of incidents occurring in the Laptev Sea, 2% in the East Siberian Sea, and 14% in the Chukchi Sea where ice conditions are the worst (2009). The extensive body of knowledge collected throughout the last century is used to plan for operations in the Russian Arctic and is predictably quite robust; however certain gaps in baseline data exist. Open information to help foreign shippers prepare for transits includes charts and maps, statistical data on ice and weather conditions, and guidelines for operations. The NSR Administration collaborates and advises foreign shippers during all stages of the transit, and relies on in-house experience. According to the NSR Administration and most of the SMEs interviewed, risks in the NSR are predictable and manageable.

Research Method

Interviews

Seven subject matter experts were interviewed. Interviews were two-tiered, semi-structured and included open-ended questions to gauge a wide variety of input. Interviewees were selected for their professional experience in Arctic marine transportation and particularly shipping operations in the NSR. Six out of seven respondents have direct experience in managing transits through the Northern Sea Route or their professional activities involve research on the subject. None of the SMEs requested confidentiality. Interviews were requested and conducted by phone, emails or in person.

During the first stage of the interview process, respondents shared empirical evidence in dealing with risk in Arctic maritime transport operations. In the second part of each interview, six out of seven SMEs were asked to weigh 18 theoretical risk factors according to probability of occurrence and level of impact. This was done to understand which factors were considered more critical. The risk factor matrix was only offered to those SMEs with significant knowledge and experience NSR transit operations. Exhibit 15 lists the respondents.

Name	Position, organization	Expertise	Location
Dr. Lawson Brigham	Distinguished professor of Geography & Arctic Policy, UAF Chair of AMSA, Arctic Council	Arctic research, Arctic maritime transportation	Anchorage, AK, USA
Mr. Andre Milschus	Head of EMEA, Hansa Heavy Lift GmbH	Arctic shipping company	Hamburg, Germany
Mr. Bruce Harland	VP, Crowley Maritime	Arctic shipping company	Anchorage, AK, USA
Mr. Morten Mejlænder-Larsen	Discipline Leader, Arctic Operation and Technology, Det Norske Veritas GL - Maritime	Classification society	Oslo, Norway
Mr. Sergey Balmasov	Director, NSR Information Office, Centre for High North Logistics	Arctic research NGO	Murmansk, Russia
Mr. Tim Keane	Operations Manager, FedNav Ltd	Arctic shipping company	Montreal, Canada
Mr. Ulf Hagen	Managing Director, Tschudi Arctic Transit	Arctic shipping company	Oslo, Norway

Exhibit 15. List of Respondents

Results

Source Categories

Kerzner (2013) states that one common practice is to classify risks according to their source, which is typically either objective or subjective.

- Objective sources: recorded experience from past projects and the current project as it proceeds
  - Lessons learned files
  - Program documentation evaluations
  - Current performance data
- Subjective sources: experiences based upon knowledgeable experts
  - Interviews and other data from subject matter experts

Both subjective and objective sources were used to identify five categories of risk factors as seen in Exhibit 16. The analysis of available literature provided objective sources such as transit statistics, types of risks previously identified and other data. Interviews with subject matter experts provided subjective data such as weighting of risk factors according to probability and impact. A total of five categories of risk factors were identified. Each category represents a root cause that may or may not develop risks. Each risk factor will in some way impact transit cost, schedule or scope. The difference between factors in cost/schedule categories and the rest are the root causes. Cost and schedule factors are associated with uncertainty in estimates and are prone to change. SMEs in personal interviews have indicated that cost and schedule estimating is inherently difficult when planning for transits given the factors listed below. The other three categories (accidents, environmental, and operational) are all sources of change during the transit's execution phase, when at sea.

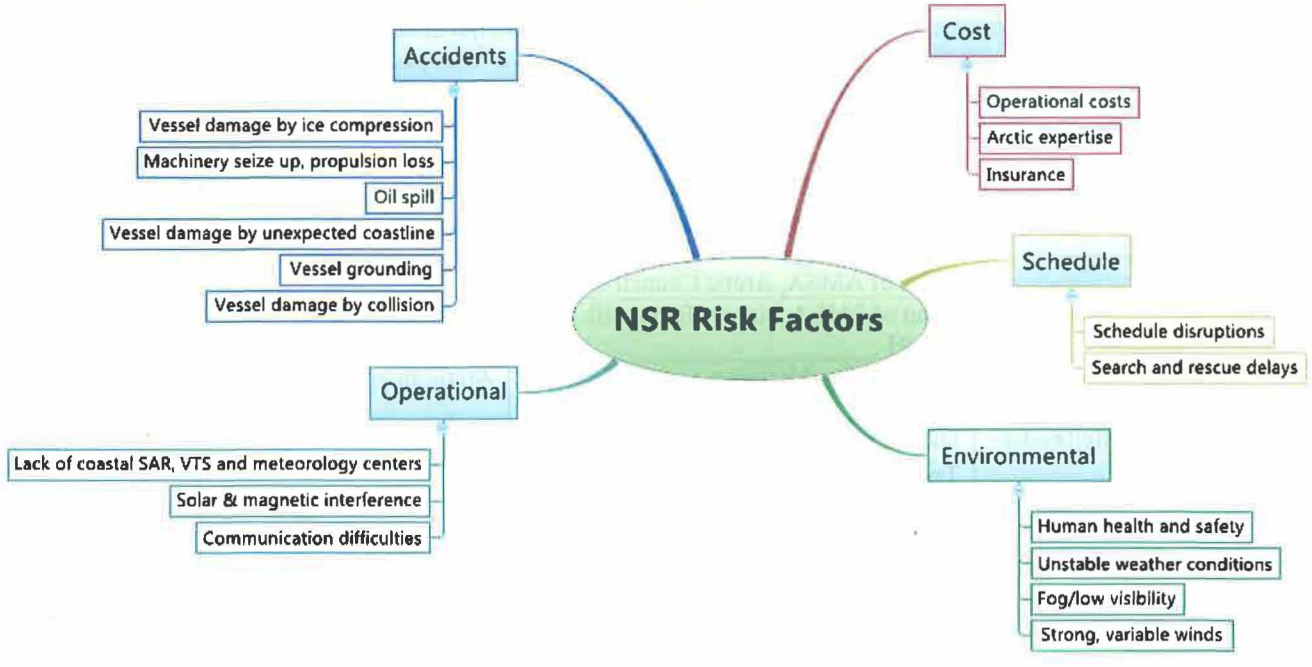


Exhibit 16. NSR Risk Factor Tree

It is important to note that risk factors are interrelated and may trigger the occurrence of secondary risks throughout the duration of the transit. For example, an accident resulting in vessel grounding or severe damage will require towage or repair time; it also may result in oil spills, and it most certainly will result in cargo delivery delays. Depending on the remoteness of the incident site to the nearest SAR center, reconnaissance teams may also take significant time to arrive. Furthermore, if grounding occurs along the coast, prolonged "pauses" increase the chances of the crew being exposed to harsh weather conditions. Time delays resulting from an accident can be translated into cost increases, especially if the success of the transit depends on a set delivery date. Each transit is unique in its nature and may undergo different incident scenarios, as well as varying degrees of impact on the triple constraint (scope, schedule and cost). A Risk Factor Breakdown Structure is available in the Appendices providing a similar view on the findings.

I. Cost

One of the two predominant risk factors is associated with direct **operational costs** such as bunker fuel, transit tariffs for technical inspections, icebreaker assistance, etc. The NSR Administration collects transit tariffs through obligatory technical inspections and services. Furthermore, depending on how the transiting vessel is ice-strengthened, each transit is required to be escorted by a Russian icebreaker under the command of an ice pilot (icebreaker captain). In such case vessels typically follow the icebreaker in a convoy. Mandatory icebreaker assistance serves as the main risk mitigation strategy employed by Northern Sea Route Administration according to

Hagen (interview, June 13, 2014) , where the icebreaker is the first responder to emergencies of any kind providing technical and medical assistance, navigational supervision, weather and ice forecasting, etc. An ice pilot is placed on the transiting vessel to assist the captain in routing and following the instructions of the preceding icebreaker in front of it. According to the NSR Information Office (2013), the following lists the responsibilities of the ice pilot:

- Assessment of ice conditions and possibility of safe navigation for the vessel in the current conditions;
- Choice of the optimal route for the vessel and the appropriate navigation tactic for the vessel on ice-infested water during independent voyage;
- Selection of speed and ways of maneuvering by the vessel to avoid hazardous interaction between the vessel's hull and propeller-rudder system and ice;
- Ways to maintain safe speed and distance to the icebreaker or another vessel ahead while proceeding in an ice caravan;
- Ways to fulfill instructions received from the icebreaker performing icebreaker support.

The level of uncertainty under which transits are undertaken in this area of the Arctic is the reason why direct operational costs contribute to risk exposure. Local conditions such as NSR regulations and policies tend to change almost each navigational season, and costs tend to fluctuate with the way transits are approved for departure. Uncertainty is partly explained by the fact that the current NSR management system has not been practiced long enough to provide a smooth and efficient process, and international transits have only become regular since approximately 2008.

The next risk factor associated with cost is recruiting and employing a team with experience in Arctic navigation. Transport operations in the Arctic are constrained by the lack of technical infrastructure; i.e., ports of call, search and rescue centers, meteorology centers, vessel traffic systems, etc., so the transit success and safety depends upon the competency of the crew (AMSA, 2009). Countries such as Norway and Russia with large-scale marine operations in the Arctic seas are tackling shortages in human resources by funding more formal educational programs for future ice pilots and crews with **Arctic expertise**. The current pool of qualified ice navigators in the maritime community is limited, and therefore quite costly.

Risks may also be transferred to a third party through cargo, vessel (hull and machinery), and liability **insurance.** Rates are somewhat challenging to estimate in the early stages of planning a transit project because underwriting authorities have yet to develop a standard for insuring Arctic transits. Vessels and cargos are underwritten given individual characteristics such as vessel and cargo type, transit distance, time in the navigational season, technical qualities of the crew, predicted risk exposure, etc. In most cases underwriters are non-profit shipowner organizations called Protection & Indemnity Clubs or insurance markets such as Lloyd's, covering dozens of risks including loss of cargo, collision liability, non-delivery, damages, etc.

II. Schedule

The second most critical risk factor is associated with implications on project **schedules**. Schedule estimates pose considerable risk in the same regard as operational costs due to a high level of uncertainty in estimates. Out of the three project constraints, schedule is most prone to change and is regarded as the largest source of risk in Arctic operations according to Harland (interview, May 12, 2014). Of critical importance are robust change management processes, as well as contingency measures. Cargo delivery dates may suffer because of unforeseen changes in ice and weather conditions, icebreaker availability, etc., all pertinent on go/no-go decisions given by the NSR administration. Environmental factors are inherently uncertain especially in the Arctic. Schedules may be delayed due to other factors at sea including emergencies which will be discussed below.

Search and rescue delays are a challenge in the NSR due to the limitations in available infrastructure. The assisting icebreaker fulfills reconnaissance functions; however, if the icebreaker itself requires towage or the transiting vessel is at sea without assistance in places other than the Barents Sea (where Russian and Norwegian Coast Guard teams are deployed in case of emergency), transit schedules may be disrupted. Vast distances between ports of call, weather and ice conditions may delay the arrival of salvage and towage teams.

III. Environmental

Human health and safety are the most significant concern for all groups of stakeholders involved in any Arctic offshore operations. Complicated by limited onshore SAR capabilities, extensive measures are put in place to assure human health is not compromised while at sea. During severe Arctic conditions, wind chills may cause machinery to seize and limitations on outside work in low temperatures may be imposed during later months of the navigational season which has implications on operating procedures and costs (Emmerson & Lahn, 2012).

Unstable weather conditions cause regular delays in transit times, along with **fog** complicating visibility, and **strong winds** also contribute to icing of the equipment and sea ice compression. Exhibit 17 shows typical and extreme weather conditions for summer and winter months in the three seas along the NSR. Arctic weather conditions have differing negative effects on vessel equipment, as well as human health and safety. Even though the navigational season is typically constrained to summer and fall months, night darkness is a separate concern for long voyages (i.e., research expeditions) with regard to human wellbeing. According to S. Balmasov (interview, April 24, 2014), visibility is challenged during late autumn and winter months when gauging the vessel's position against the flat shorelines becomes increasingly difficult, thus creating a hazard.

	Kara Sea	**Laptev Sea**	**East Siberian Sea**
Winter Season	Oct-May	Oct-June	Oct-May/June
Temp typical	-26C	-30C	-21C
Temp extreme	-48C	-50C	-48C
Ice thickness	1.8-2.5m	1.6-2.5m	1.2-2m
Fog	100 days	75 days	80 days
Summer season	June-Sept	July-Sept	Mid June-Sept
Temp typical	7C	8C	15C
Temp extreme	20C	26C	30C

Exhibit 17. Current Winter and Summer Conditions along the NSR (London Market Joint Hull Committee, 2012)

Winds in the Arctic offshore tend to change direction quickly which in turn affects the formation of ice compression. Several interview respondents testified that the most common vessel damage is damage to the hull caused by ice. These and other risk factors pertaining to damages and accidents are discussed further on. According to the International Northern Sea Route Programme (1996), even nuclear icebreakers cannot keep in motion during severe ice compression, and "the combined effect of rapidly flowing brash ice and ice compression have caused total losses of ships". Wind and current induced ice conditions are most difficult in narrow straits where the sea level tends to change creating 'ice-rivers' or dynamic ice flows, i.e., in the Kara Strait. According to Milschus (interview, June 17, 2014), spontaneous ice formation caused by high winds and waves is a considerable risk, as well as the possibility of pausing the transit to shelter the ship for an unknown period of time, consequently delaying the delivery date and increasing costs.

IV. Operational

Lack of coastal vessel tracking systems (VTS), search and rescue and meteorology centers affect safety, as well as transit costs and schedules in case of emergency. More developed infrastructure is available around the Barents Sea area but parts of the eastern NSR region are underserviced. While private industries at large E&P project sites utilize their own emergency response capacity, more SAR infrastructure needs to be developed to provide maximum security in the NSR (AMSA, 2009). Assisting icebreakers or icebreakers closest to incident area will provide all of the VTS, SAR and meteorological services. Efforts to revitalize coastal infrastructure are already taking place but the current conditions contribute to the necessity of icebreaker escort for routing, weather forecasts and safety at sea. While support infrastructure may be lacking capacity, icebreakers carry crews of 120 people with 2 doctors aboard, as well as medical and oil recovery equipment.

Solar and magnetic interference phenomena in the Arctic may affect equipment. According to Emmerson and Lahn (2012), high-frequency radio and GPS are degraded above 70-72 degrees north and geostationary satellite

geometry also poses an issue, while **internal communication difficulties** have become a challenge addressed by foreign flag crews. Although ice pilots aboard a foreign flag vessel are always fluent in English, the main language of the accompanying icebreaker crew and most of the supporting staff ashore is Russian. In order to mitigate miscommunication critical in any international environment, some shippers employ Russian speaking staff for different stages of the project.

V. Accidents

Ice and ice compression are the most common causes of **vessel damage.** Damage mostly affects the hull of the ship which is a common risk underwritten by P&I clubs. **Machinery seizure, propulsion loss caused by icing/ice damage** also need to be addressed when planning a transit, so that repairs and maintenance do not affect delivery times and prolong time at sea. According to the NSR Information Office, all NSR seaways are currently routed through one-year ice (1.6m). Arctic-class icebreakers can open passages in ice up to 2.3m thick. By July, ice compression levels fall and by October the NSR routes are completely 'free' of ice (Northern Sea Route Information Office, n.d.), reducing the probability of any negative consequences to 'low'. However, risks associated with ice compression should not be disregarded as conditions fluctuate year by year, i.e., in 2013 the navigational season opened late in August because of high ice levels and safety concerns. According to S. Balmasov (interview, April 24, 2014), a gas tanker captain did not follow instructions during a transit in 2013 and entered a moderately difficult ice compression zone which resulted in damages to the ballast tank. Incidents caused by human error can be reduced, if ice pilot instructions and recommendations are followed.

Oil spills are uncommon and to date there haven't been any instances recorded due to tight safety controls imposed through technical inspections during the permitting process, and due to mandatory icebreaker support at sea. Escorting icebreakers carry oil spill recovery equipment on board. Although a considerable risk due to limited emergency infrastructure ashore, there is minimal probability of occurrence.

Encountering an unexpected coastline, grounding in shallow water and **vessel damage by collision** are probable when routing directions given by the ice pilot are not followed, particularly in the East Siberian Sea in two very narrow straits: the Sannikov strait is only 13-15m deep and the Laptev strait can be 8-9m deep, while the typical icebreaker draft varies between 8-10 m. These areas require very careful navigation. In case a vessel runs aground, an escorting icebreaker will be able to provide towage. Collisions are highly unlikely with experienced crews but may still pose a threat due to human error.

Probability & Impact Categories

In the second round of interviews, SMEs were asked to rate each identified factor according to impact and probability to gauge the criticality of each factor based on subjective opinions. The following risk factor matrix depicts average scores. It was created to provide a high-level visual representation of the categories of factors involved and their perceived importance. SMEs' attitudes toward risk assessment and classification vary across organizations. Identified risk pools will be different depending on the nature of each transit's specifications, scope, schedule, cost, technical and other constraints. A more detailed view on the Risk Factor Classification Matrix including each SME's responses is available under Appendix B.

According to average scores, no single factor was categorized as high probability/high impact. The common perception shared among the majority of SMEs interviewed was that the risk environment is not critically dangerous or unmanageable. This may speak on behalf of these organizations being more risk tolerant and even risk-taking. However, more detailed research based on quantitative data analysis with the use of more significant samples of baseline statistics on completed transits is required to support such conclusions with a higher level of confidence. The following analysis breaks down factors by probability and impact categories.

Legend	
1	low probability, low impact
2	high probability, low impact
3	low probability, high impact
4	high probability, high impact

Risk Factor Classification			
Risk Factor	**Description**	**Average**	**Type**
Vessel damage by ice compression	May require towage and additional transit time	2.50	Execution: Accidents
Machinery seize up/propulsion loss caused by icing/ice damage	May require towage and additional transit time	2.50	
Unstable weather conditions	Quickly changing weather conditions, harsh weather conditions affect operations	1.83	Environmental
Fog/low visibility		2.00	
Strong, variable winds	Ice compression	1.67	
Human health and safety	Human health and safety affected by lack of light, harsh weather, other hazards while on board	1.33	
Lack of coastal meteorology, SAR and VTS centers	Unreliable weather forecasts, traffic forecasts at choke points, lack of technical maintenance	1.83	Operational
High operational costs	High bunker fuel costs, ice breaker support, other	3.33	Planning: cost risk
Costly Arctic expertise	Hiring Arctic maritime transportation experts, ice pilots, etc.	1.67	
Costly insurance	High cargo/vessel insurance rates	2.17	
Schedule disruptions	Operations may be delayed because of go/no-go decisions	2.83	Planning: schedule risk
Search and rescue delays	Salvage and towage operations delayed by remoteness	3.17	Execution: schedule risk
Solar/magnetic interference phenomena	Communication instruments failure	1.33	Operational
Communication difficulties	Main operational language is Russian	1.33	
Oil spill	Fuel spill into the ocean caused by vessel damage	3.00	Execution: Accidents
Vessel damage by encountering unexpected coastline	May require towage and additional transit time	3.00	
Vessel grounding	Requires towage and additional transit time	3.00	
Vessel damage caused by collision	Collision of vessel and supporting icebreaker	2.83	

Exhibit 18. Risk Factor Classification

3 points average	low probability, high impact factors

These factors can be characterized by the severity of concerns shared among stakeholder opinions over changing cost and schedule estimates, and most critical among possible incidents that affect safety.

- The highest rating (3.33 points) was given to operational costs, a factor associated with uncertain and changing cost estimates. This risk factor may cause changes during the planning stage of the transit when direct and overhead costs are estimated.

- The second most critical rating was given to search and rescue delays with a score of 3.17 points. All interviewees agreed that safety in remote areas is a large concern given limited coastal infrastructure, long distances between ports of call, and Coast Guard centers.
- The third place in criticality (3.00 points) was split between three accidents during execution of the transit at sea: oil spill, vessel damage by encountering unexpected coastline and grounding in shallow water.
- The fourth place was split between schedule disruptions and vessel damage by collision, both 2.83 points. While the latter received even scores of 3 for the most part, views on irregular schedules varied greatly. Two opinions categorized this risk factor as high probability/high impact, two more as low probability/high impact, one as high probability/low impact, and another as low probability/low impact.
- Two factors associated with accidents shared the next place in criticality (2.50 points) – vessel damage by ice compression and machinery seize-up, loss of propulsion caused by ice.

2 points average	high probability, low impact

With the exception of costly insurance rates, the following category of factors consists of challenging weather conditions:

- Costly insurance received a score of 2.17 points and was deemed as high probability/low impact risk factor
- It was followed by fog/low visibility with a weighting of 2.00 points
- Unstable weather conditions and lack of meteorological, SAR, VTS and other infrastructure shared the 8th place in the ranking and received 1.83 points both
- Strong, variable winds received the 9th place and 1.67 points

1 point average	low probability, low impact

Only three factors shared the last rating in the matrix and a total of 1.33 points each:

- The effect of Arctic environment on human health and safety
- Communication difficulties
- Technical difficulties with communication technology caused by solar/magnetic phenomena interference

Conclusion

Findings of this research provide a basic description of the NSR risk environment formed by five identified risk factor categories: cost, schedule, operational, environmental and accidents. Risk factors were determined through analyzing available literature and interviewing subject matter experts. According to interviewee opinions, most critical factors in terms of probability of occurrence and impact on transit scope, schedule and cost constraints are uncertain cost and schedule estimates, concerns over search and rescue capabilities, and high impact accidents at sea. In the near future, marine traffic along the Northern Sea Route will remain constrained to cabotage operations surrounding exploration and production projects in the western half of the route; however, growth is expected in destinational cargo shipping, as well as Arctic research and tourism. When planning a transit project along the NSR, gaps in available informational on risk exposure and tight regulatory control from the NSR administration pose significant entry barriers for new foreign shippers. The risk factors described in this research require shippers to have robust risk management practices and a level of flexibility to withstand implications on the three project constraints. It is expected, however, that as infrastructure develops onshore and multi-year ice coverage continues to recede, the severity of risk probability and impact will also diminish allowing safer and more reliable maritime traffic conditions in the Arctic.

Limitations

Findings are limited to the subjective opinions of the author and interviewed SMEs. Further research based on quantitative data analysis with more significant samples of baseline data is required to provide objective conclusions with a higher degree of confidence.

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References

"Dry bulk cargo", (n.d.). In *Transportation Dictionary Online.* Retrieved from http://www.transportation-dictionary.org/Dry_Bulk_Cargo

"Project Risk Management – Tools and Techniques", (2011). Retrieved from https://owl.english.purdue.edu/owl/resource/560/10/

Ahlenius, H. (2007). *Northern Sea Route and the Northwest Passage Compared with Currently Used Shipping Routes.* Retrieved from http://www.grida.no/graphicslib/detail/northern-sea-route-and-the-northwest-passage-compared-with-currently-used-shipping-routes_1336

Arctic Council (2009). *Arctic Marine Shipping Assessment 2009 Report (2nd printing)*

ArcticEcon (2012). *The Northern Sea Route as a Viable Development – Russia's Fleet of Atomic Icebreakers.* Retrieved from http://arcticecon.wordpress.com/?s=northern+sea+route

BG Group. (2014) [Graph illustration Asia LNG Demand Growth- Rising Expectations]. *Global LNG Update [PDF document].* Retrieved from http://files.the-group.net/library/bggroup/files/doc_526_t.pdf

Blunden, M. (2012). Geopolitics and the Northern Sea Route. *International Affairs, 88,115-129*

Bruno, P. (n.d.). Maritime Classification Societies Listings. Retrieved from http://maritime.about.com/od/shipbuilding/tp/Maritime-Classification-Society-Listings.htm

Christiansen, M., Fagerholt, K., Nygreen, B., Ronen, D., (2007). Chapter 4 Maritime Transportation, *Handbooks in Operations Research and Management Science,* 14, Pages 189-284. Retrieved from http://www.sciencedirect.com/science/article/pii/S0927050706140049

Det Norske Veritas (2010). Beluga Shipping Masters First Commercial Transit of the Northeast Passage. Retrieved from http://www.dnv.com/industry/oil_gas/publications/updates/arctic_update/2010/01_2010/BelugaShippingmastersfirstcommercialtransitoftheNortheastPassage.asp

Dobbins, J. P. IV (2001). *Development of an Inland Marine Transportation Risk Management Decision Support System.* Retrieved from ProQuest Dissertations and Theses, http://search.proquest.com.proxy.consortiumlibrary.org/docview/275624489?accountid=14473

Emmerson, C., & Lahn, G. (2012). *Arctic Opening: Opportunity and Risk in the High North.* Retrieved from http://www.chathamhouse.org/sites/files/chathamhouse/public/Research/Energy%2C%20Environment%20and%20Development/0412arctic.pdf

Granberg, A. (1998). The Northern Sea Route: Trends and Prospects of Commercial Use. *Ocean & Coastal Management, 41, 175-207*

Heideman, T. (1996). Working Paper No. 39-1996, I.1.8 Influence of Ice Compression on Feasible Navigation on the Northern Sea Route from the *International Northern Sea Route Programme.*

International Maritime Organization (2014). *Shipping in Polar Waters: Development of an International Code Of Safety for Ships Operating in Polar Waters.* Retrieved from *http://www.imo.org/MediaCentre/HotTopics/polar/Pages/default.aspx*

Kaempf, M. (2011). *Risk Management in the Arctic Offshore: Wicked Problems Require New Paradigms.* Retrieved from the Engineering Science & Project Management Department archive, University of Alaska Anchorage.

Kerzner, H.R. (2013). *Project Management: A Systems Approach to Planning, Scheduling, and Controlling.*

Knowles, R.D., Shaw, J., Docherty, I., 2008. *Transport Geographies: Mobilities, Flows and Spaces.* London: Wiley

Liu, M., & Kronback, J. (2010). The Potential Economic Viability of Using the Northern Sea Route (NSR) as an Alternative Route between Asia and Europe. *Journal of Transport Geography, 18, 434-444*

Lloyd, T. (1950). The Northern Sea Route. In *Russian Review, 9, No.2.* Retrieved from http://www.jstor.org/stable/125455

London Market Joint Hull Committee. (2012). [Graph illustration Winter and Summer Conditions along the NSR]. *Arctic Opening: Opportunity and Risk in the High North.* Retrieved from http://www.chathamhouse.org/sites/files/chathamhouse/public/Research/Energy%2C%20Environment%20and%20Development/0412arctic.pdf

Novatek (N.d.). *South-Tambeyskoye Field (Yamal LNG Project).* Retrieved from http://www.novatek.ru/en/business/yamal/southtambey/

Ostreng, W. (2009). The Northeast Passage and the Northern Sea Route. *ARCTIS Database.* Retrieved from https://owl.english.purdue.edu/owl/resource/560/10/

Panitchpakdi, S. (2012). *Review of Maritime Transport 2012.* Retrieved from http://unctad.org/en/pages/PublicationWebflyer.aspx?publicationid=380

Pedersen, T. (2012). Record Number of Bulk Carriers through Northern Sea Route. *The Barents Observer.* Retrieved from http://barentsobserver.com/en/business/record-number-bulk-carriers-through-northern-sea-route

Project Management Institute (2009). *Practice Standard for Project Risk Management.* Newtown Square, PA: Project Management Institute.

Project Management Institute (2009). *A Guide to the Project Management Body of Knowledge (PMBOK Guide).* Newtown Square, PA: Project Management Institute.

Renton, M. (2013). *Yamal LNG Puts Russian Gas on the Map.* Retrieved from http://info.lloydslistintelligence.com/yamal-lng-puts-russian-gas-on-the-map/

The Northern Sea Route Information Office (n.d.). *Ice Concentration.* http://www.arctic-lio.com/nsr_ice

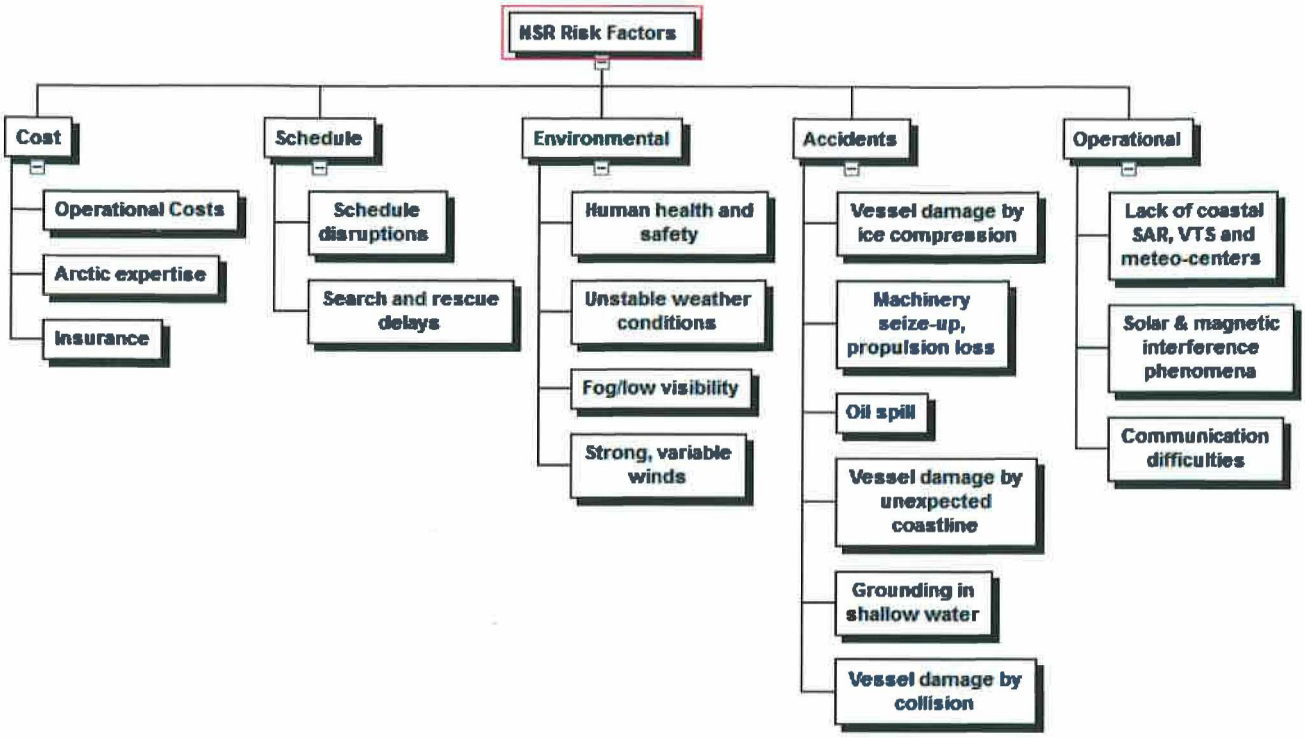
The Northern Sea Route Information Office (2012). *Transit Statistics* [data file]. Retrieved from http://www.arctic-lio.com/nsr_transits

The Northern Sea Route Information Office (2014) [Graph illustration Dynamic of Cargo Volume on the NSR over the Last 25 Years n.d.]. *Transit Statistics.* Retrieved from http://www.arctic-lio.com/nsr_transits

Tschudi Shipping Company (2014). [Graph illustration Distances and Potential Days Saved for Asian Transport from Kirkenes (Norway) and Murmansk (Russia)]. *The Northern Sea Route: Commercial Experiences and Potential [PowerPoint slides].* Retrieved from http://www.maritimecenter.dk/public/dokumenter/EMUC/Konferencer/2014/Blue%20Business/Jon%20E.%20Sundnes.pdf

United Nations Conference on Trade and Development (2013). [Graph illustration International Seaborne Trade, Selected Years in Millions of Tons Loaded (five major bulks: iron ore, grain, coal, bauxite/alumina and phosphate rock]. *Review of Maritime Transport 2013.* Retrieved from http://unctad.org/en/PublicationsLibrary/rmt2013_en.pdf

Appendix A. Risk Factor Breakdown Structure



Appendix B. Risk Factor Classification Matrix

		Ulf Hagen, Tschudi	Morten Meijlaender-Larsen, DNV GL	Bruce Harland, Crowley	Andre Milschus, HHL	Dr. Lawson Brigham, UAF/Coast Guard	Sergey Balmasov, CHNL	Average	Type
Risk Factor	Risk Description	Rating							
Vessel damage by ice compression	May require towage and additional transit time	2	1	3	3	3	3	2.50	Execution: Accidents
Machinery seize up/propulsion loss caused by icing/ice damage	May require towage and additional transit time	3	2	1	3	3	3	2.50	
Unstable weather conditions	Quickly changing weather conditions, harsh weather conditions affect operations	1	2	2	2	2	2	1.83	Environmental
Fog/low visibility		2	2	2	2	2	2	2.00	
Strong, variable winds	Ice compression	1	2	2	2	2	1	1.67	
Human health & safety	Human health and safety affected by lack of light, harsh weather, other hazards while on board	1	1	2	2	1	1	1.33	
Lack of coastal meteorology, SAR and VTS centers	Unreliable weather forecasts, traffic forecasts at choke points, lack of technical maintenance	1	2	2	2	3	1	1.83	Operational
High operational costs	High bunker fuel costs, ice breaker support, other	2	2	4	4	4	4	3.33	Planning: cost risk
Costly Arctic expertise	Hiring Arctic maritime transportation experts, ice pilots, etc.	2	3	2	1	1	1	1.67	
Costly insurance	High cargo/vessel insurance rates	2	2	2	1	4	2	2.17	
Schedule disruptions	Operations may be delayed because of go/no-go decisions	2	3	3	4	4	1	2.83	Planning: schedule risk
Search and rescue delays	Salvage and towage operations delayed by remoteness	2	3	4	3	3	4	3.17	Execution: schedule risk
Solar/magnetic interference phenomena	Communication instruments failure	1	2	1	2	1	1	1.33	Operational
Communication difficulties	Main operational language is Russian	1	2	1	2	1	1	1.33	
Oil spill	Fuel spill into the ocean caused by vessel damage	3	3	3	3	3	3	3.00	Execution: Accidents
Vessel damage by encountering unexpected coastline	May require towage and additional transit time	3	3	3	3	3	3	3.00	
Grounding in shallow water	Requires towage and additional transit time	3	3	3	3	3	3	3.00	
Vessel damage by collision	Collision of vessel and icebreaker	3	3	3	3	3	2	2.83	

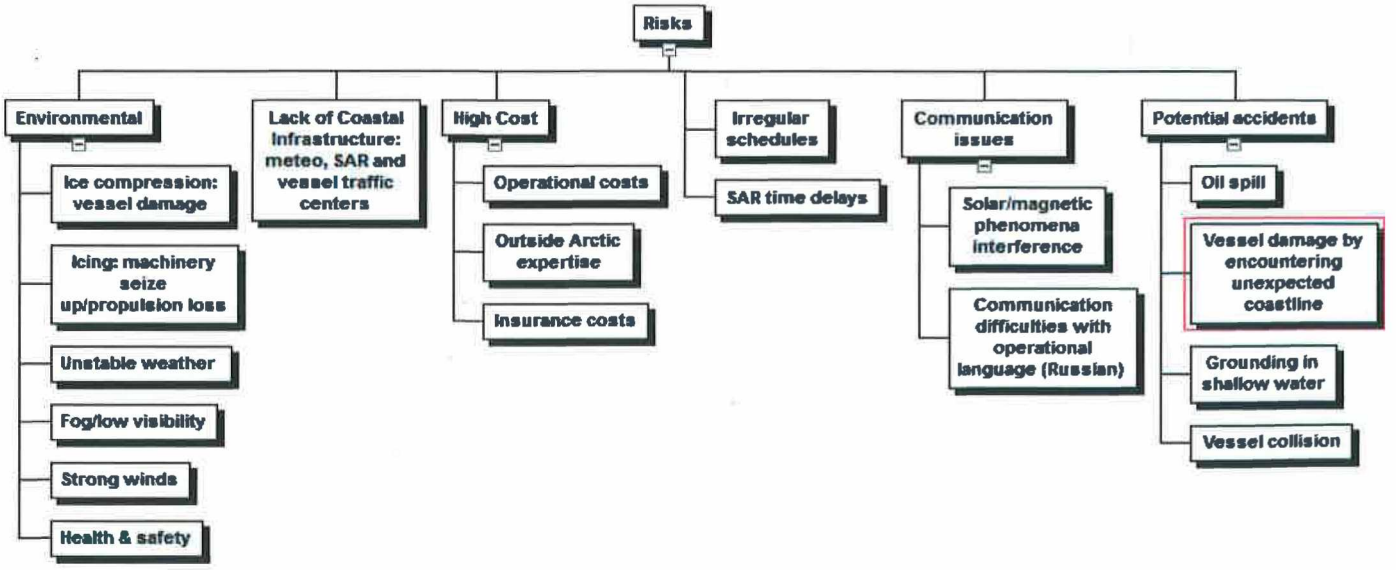
Appendix C. Interview Protocol

Instructions

Good morning (afternoon). Thank you for agreeing to participate in this study of the risk environment associated with the expansion of the Northern Sea Route. I will be recording the interview to ensure that my notes are accurate and that I can capture all the details while carrying on an attentive conversation with you. Your participation in this study is voluntary. You may stop at any time and you are not obligated to answer any questions. I am the only one who will have access to links between your name and organization, and the responses you provide.

If you wish to remain unidentified for the purposes of this research, my final research analysis will contain only generic references to the sources of the information you provide. Data will be compiled in such a way that you cannot be identified. Your name and affiliation will be kept confidential.

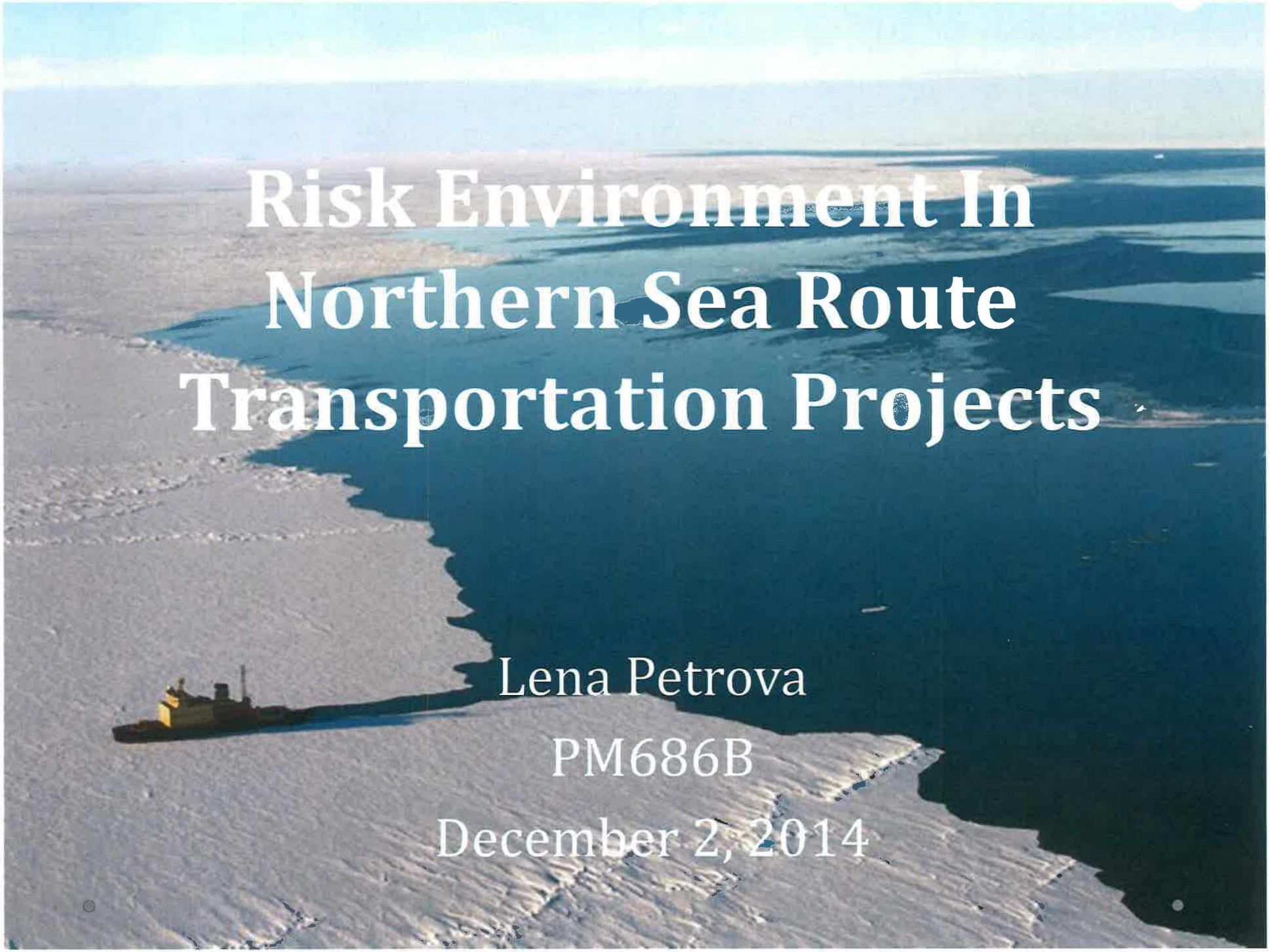
Q1. Do you wish that your name and responses be kept confidential?
Q2. What organization are you affiliated with?
Q3. What role do you have within your organization?
Q4. Have you or your organization had any direct experience with maritime transportation in the NSR?
Q5. What is your experience with the development of the Northern Sea Route?
Q6. What risks and risk factors in maritime transportation in this region are you aware of?
Q7. What are the most important risk factors in maritime transportation in the Arctic?
Q8. Is it the ice/weather conditions or the regulatory environment (icebreaker assistance fees, long application period, and uncertainty) that has the biggest impact on project cost and schedule in transportation projects in the NSR?
Q9. Do you see intra-Arctic and trans-Arctic transport growing in the next 5 years at the rate which has been predicted or is it still a long-term prospect?
Q10. If I were a logistics company preparing to transport bulk cargo from Western Europe to Southeast Asia, what are the biggest risks that can potentially impact the success of my operation in terms of cost, scope and schedule?
Q11. Here is a breakdown of potential risks and risk factors. Would you like to add any risks or modify any content?



Q12. Please rate each risk factor with one of the following:

1	low probability, low impact
2	high probability, low impact
3	low probability, high impact
4	high probability, high impact

Risk Name	*Description*	*Rating*
Vessel damage by ice compression	May require towage and additional transit time	
Machinery seize up/propulsion loss caused by icing/ice damage	May require towage and additional transit time	
Unstable weather conditions	Quickly changing weather conditions, harsh weather conditions affect operations	
Fog/low visibility		
Strong winds		
Health and safety	Human health and safety affected by lack of light, harsh weather, other hazards while on board	
Lack of coastal meteorological, SAR and VTS centers	Unreliable weather forecasts, traffic forecasts at choke points, lack of technical maintenance	
Costly operational costs	High bunker fuel costs, ice breaker support, other	
Costly outside Arctic expertise	Hiring Arctic maritime transportation experts, ice pilots, etc.	
Costly insurance	High cargo/vessel insurance rates	
Irregular schedules	Operations may be delayed because of go/no-go decisions	
SAR time delays	Salvage and towage operations delayed by remoteness	
Solar/magnetic phenomena interference	Communication instruments failure	
Communication difficulties with operational language (Russian)	Main operational language is Russian	
Oil spill	Fuel spill into the ocean caused by vessel damage	
Vessel damage by encountering unexpected coastline	May require towage and additional transit time	
Grounding in shallow water	Requires towage and additional transit time	
Vessel damage caused by collision	Collision of vessel and supporting icebreaker	



Risk Environment In Northern Sea Route Transportation Projects

Lena Petrova

PM686B

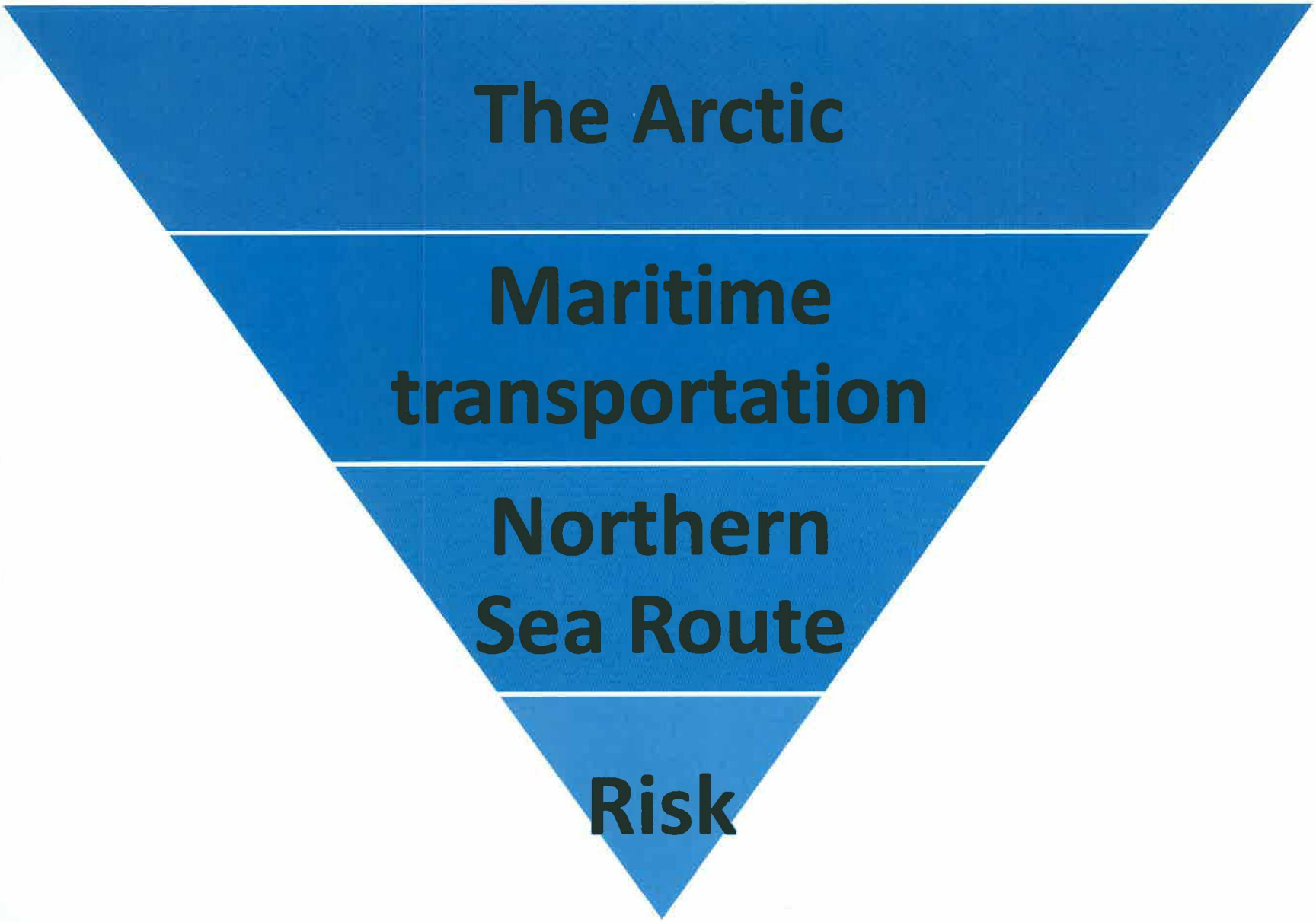
December 2, 2014

Contents

- **Background**

- **Research**
- **Findings**

- **Future research ideas**
- **Lessons Learned**

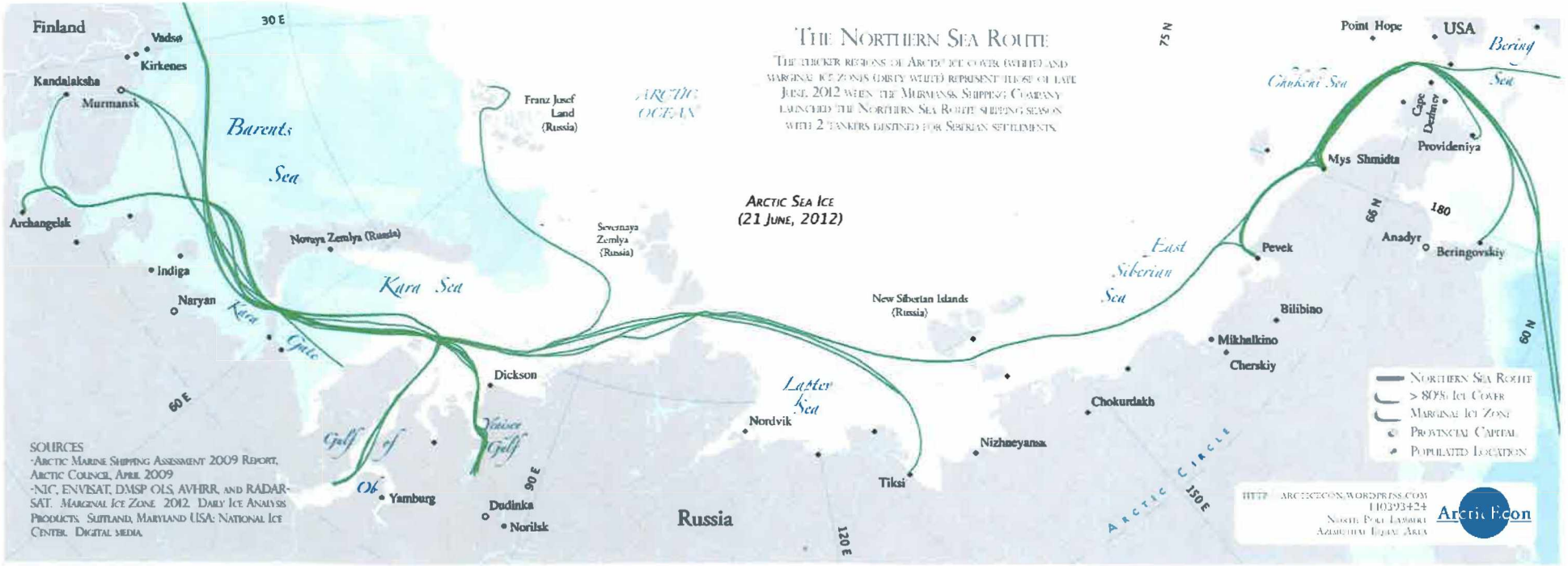

The Arctic
Maritime transportation
Northern Sea Route
Risk

Maritime shipping

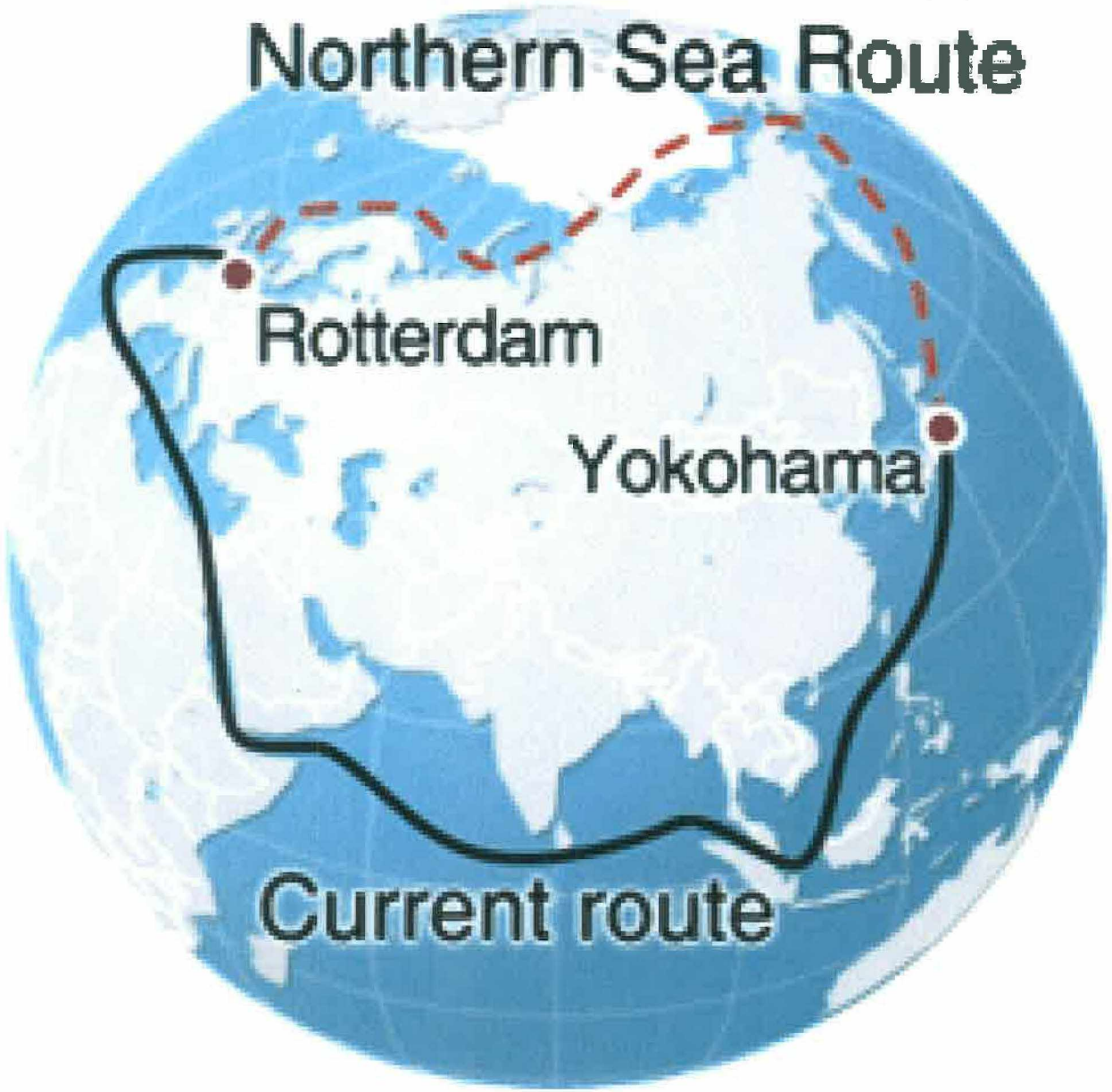
- 70% of international trade
- 26% of undiscovered oil and gas reserves in the Arctic
- Solution to Arctic logistics

If ice…then risky

The Northern Sea Route



- Changing ice conditions
- Bulk cargo shipping
- Long-term opportunity


Northern Sea Route
Rotterdam
Yokohama
Current route

Transportation Modes

Cabotage

Destinational

Assumption #1

Trans-Arctic voyages = *projects*

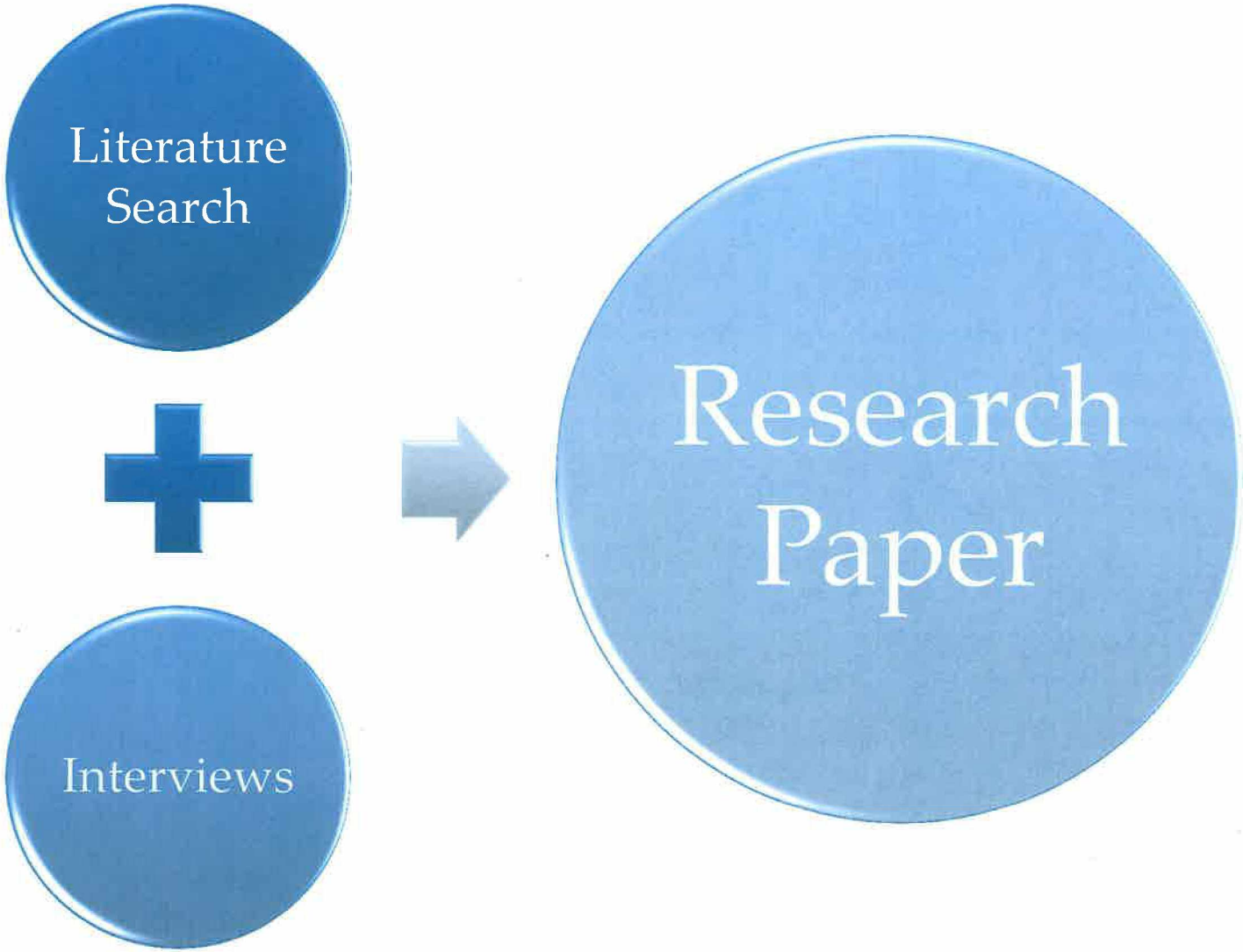
Questions

- What are the unique challenges of executing maritime transportation projects in this region?
- What risk factors are or should be addressed by shipping companies when planning a transit?
- What risk factors contribute to enhanced realism and adaptations in project scope, schedule and cost estimates?

Assumption #2

Risk factors = *risk environment*

Research Method



Interviewees

ARCTIC COUNCIL

HANSA HEAVY LIFT

CHNL CENTRE FOR HIGH NORTH LOGISTICS

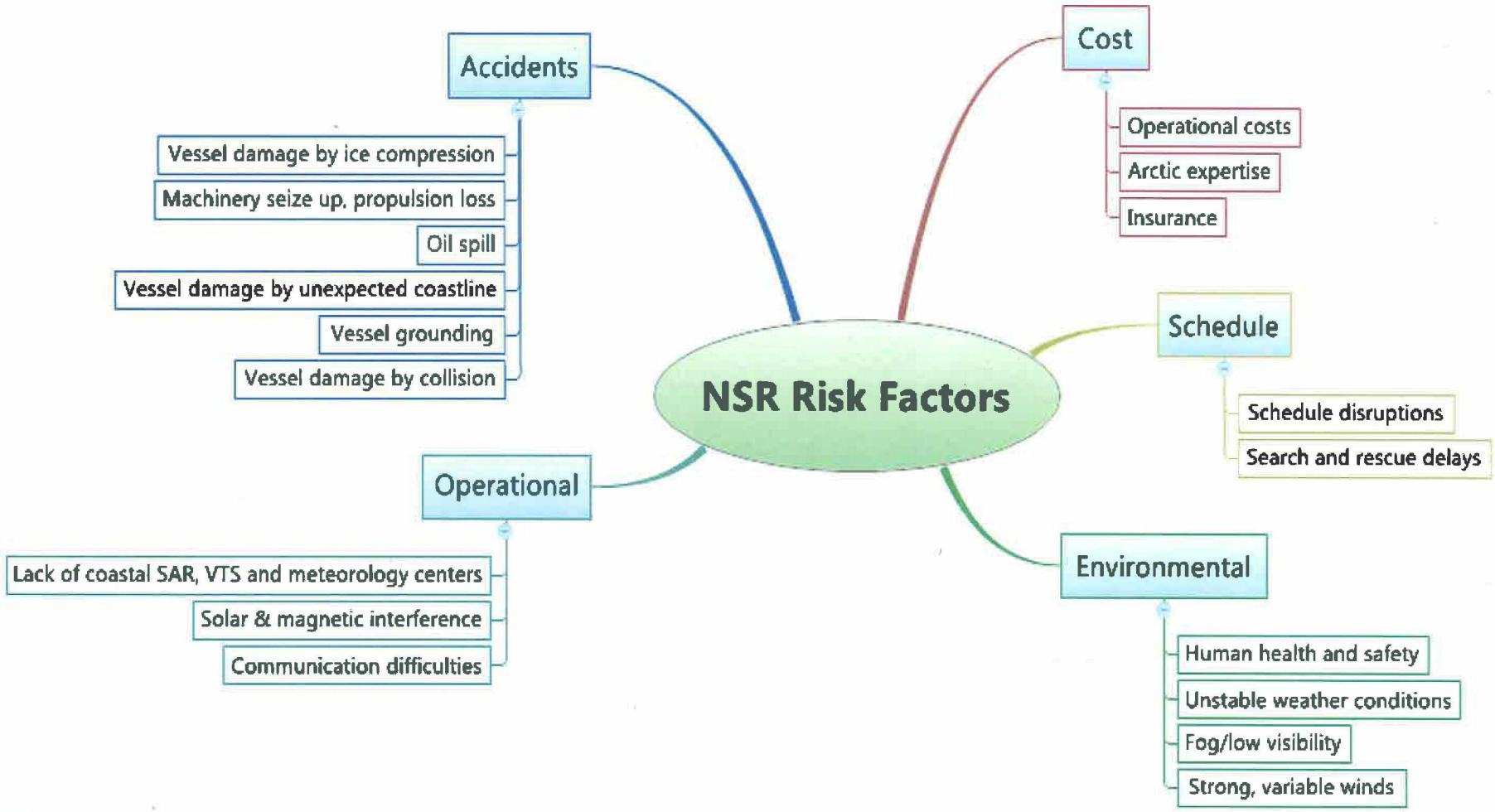
DNV GL

TSCHUDI

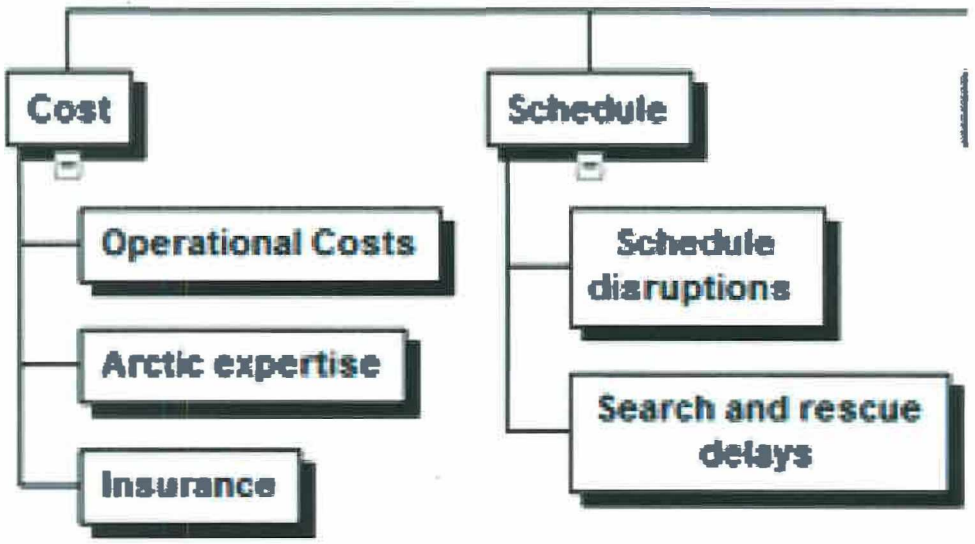
CROWLEY

FEDNAV
DELIVERING A HIGHER STANDARD

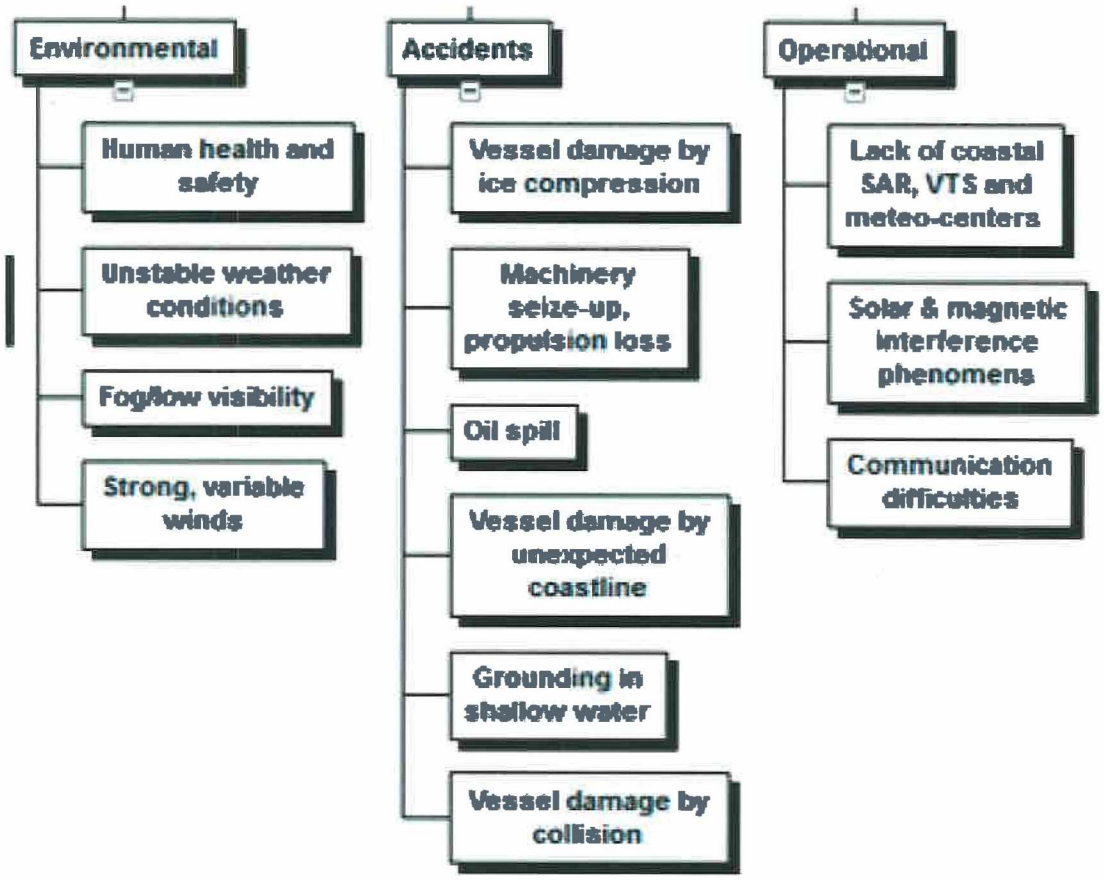
Findings


NSR Risk Factors
Accidents
Vessel damage by ice compression
Machinery seize up, propulsion loss
Oil spill
Vessel damage by unexpected coastline
Vessel grounding
Vessel damage by collision
Cost
Operational costs
Arctic expertise
Insurance
Schedule
Schedule disruptions
Search and rescue delays
Operational
Lack of coastal SAR, VTS and meteorology centers
Solar & magnetic interference
Communication difficulties
Environmental
Human health and safety
Unstable weather conditions
Fog/low visibility
Strong, variable winds

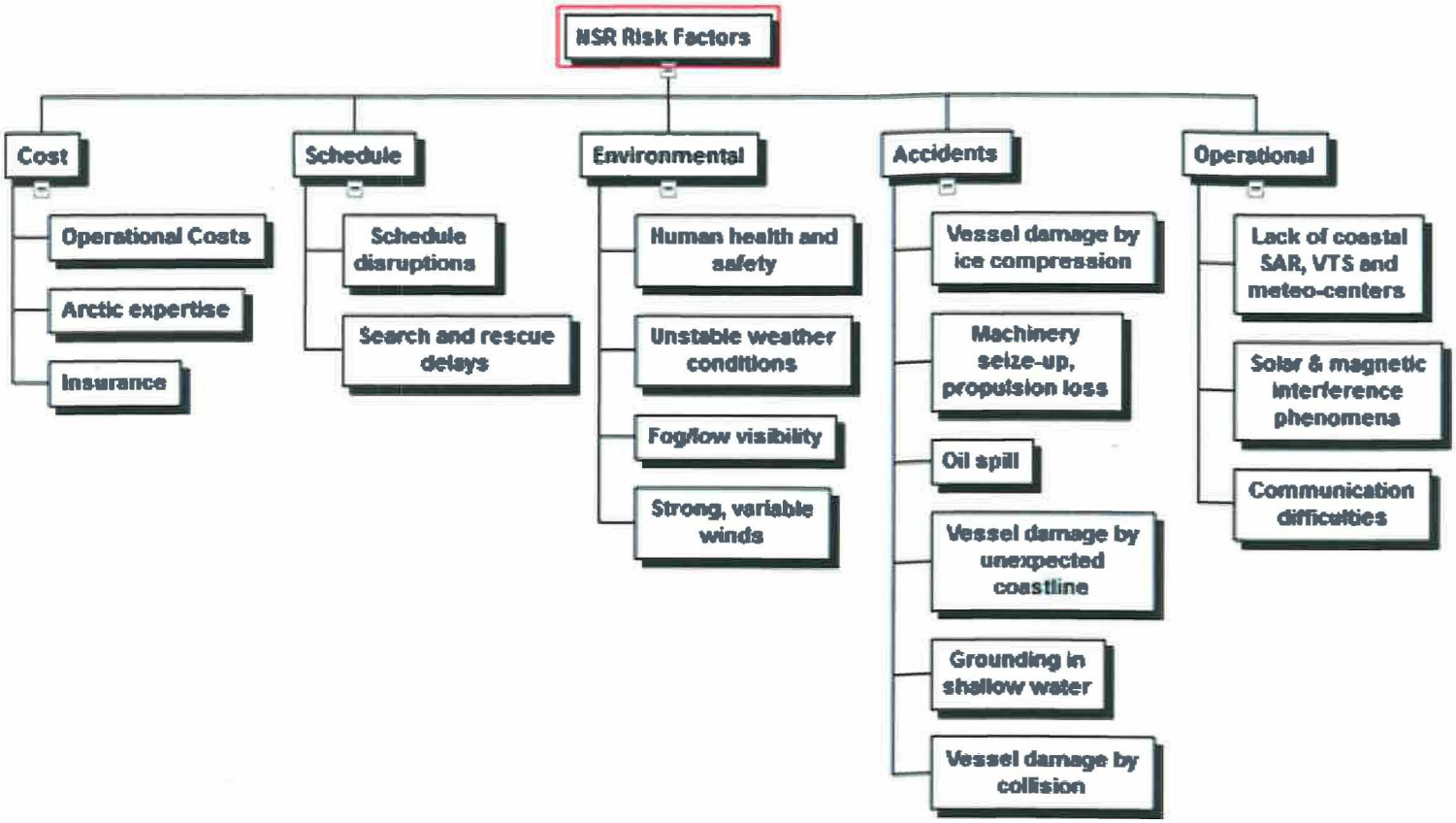
Planning


Cost
Operational Costs
Arctic expertise
Insurance
Schedule
Schedule disruptions
Search and rescue delays

Execution


Environmental
Human health and safety
Unstable weather conditions
Fog/low visibility
Strong, variable winds
Accidents
Vessel damage by ice compression
Machinery seize-up, propulsion loss
Oil spill
Vessel damage by unexpected coastline
Grounding in shallow water
Vessel damage by collision
Operational
Lack of coastal SAR, VTS and meteo-centers
Solar & magnetic interference phenomens
Communication difficulties

Risk Factor Breakdown



Outlook


Arctic Sea Ice
1984
6.70 million square kilometers
(2.59 million square miles)
Alaska
(U.S.A)
Canada
2012
3.41 million square kilometers
(1.32 million square miles)
Alaska
(U.S.A)
Canada

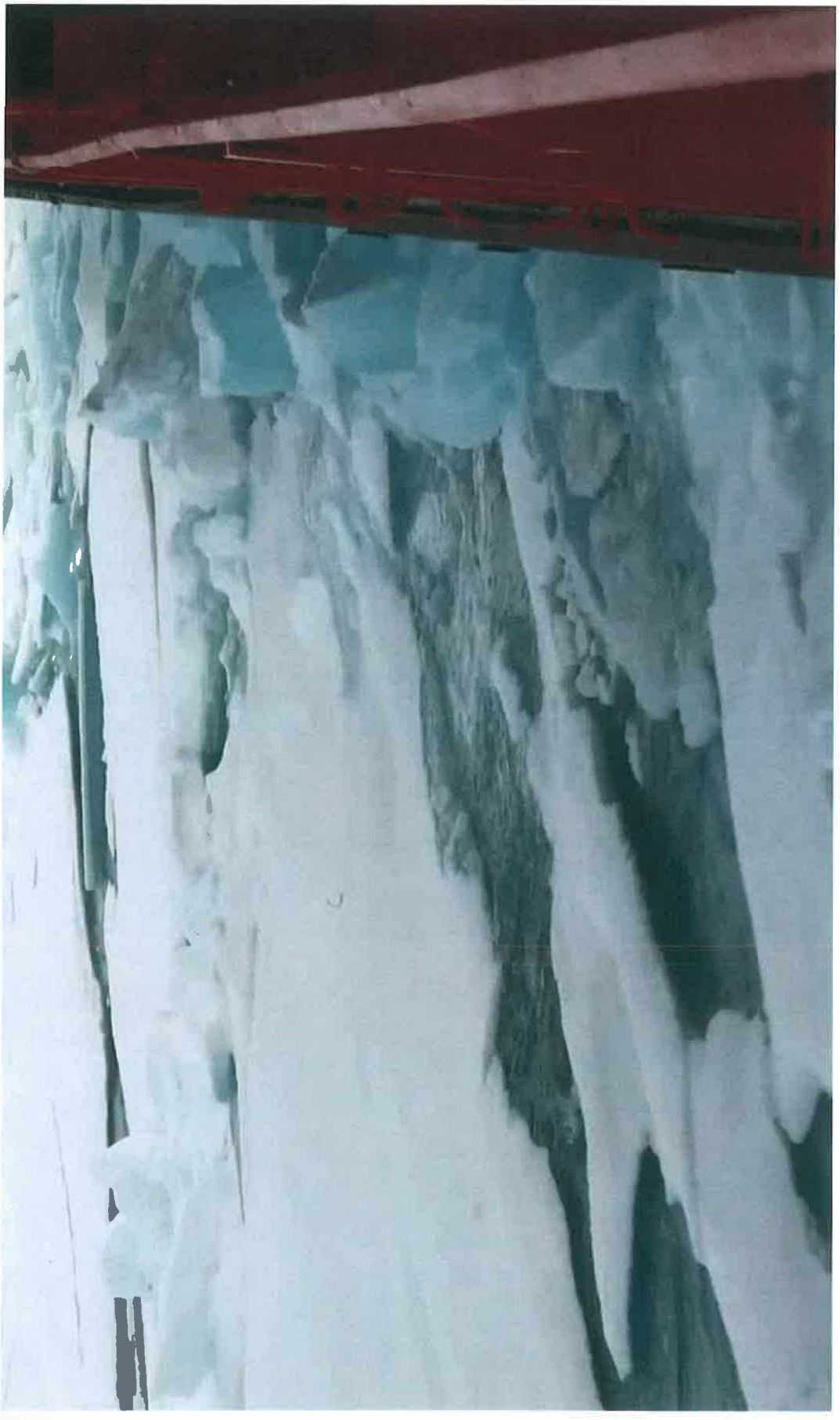
Lessons Learned

Legend	
1	low probability, low impact
2	high probability, low impact
3	low probability, high impact
4	high probability, high impact

Ulf Hagen, Tschudi	Morten Meijlaender-Larsen, DNV GL	Bruce Harland, Crowley	Andre Milschus, HHL	Dr. Lawson Brigham, UAF/Coast Guard	Sergey Balmasov, CHNL	Average	Type
Rating							
2	1	3	3	3	3	2.50	Execution: Accidents
3	2	1	3	3	3	2.50	
1	2	2	2	2	2	1.83	Environmental
2	2	2	2	2	2	2.00	
1	2	2	2	2	1	1.67	
1	1	2	2	1	1	1.33	
1	2	2	2	3	1	1.83	Operational
2	2	4	4	4	4	3.33	Planning: cost risk
2	3	2	1	1	1	1.67	
2	2	2	1	4	2	2.17	
2	3	3	4	4	1	2.83	Planning: schedule risk
2	3	4	3	3	4	3.17	Execution: schedule risk
1	2	1	2	1	1	1.33	Operational
1	2	1	2	1	1	1.33	
3	3	3	3	3	3	3.00	Execution: Accidents
3	3	3	3	3	3	3.00	
3	3	3	3	3	3	3.00	
3	3	3	3	3	2	2.83	

Future Research

- Regulatory frameworks:
  - Implementation and implications of the Polar Code
- Uncertainty and risk in the Arctic offshore
- Arctic stakeholder opinions
- Gaps in coastal infrastructure



Questions and comments

RISK ENVIRONMENT IN NORTHERN SEA ROUTE TRANSPORTATION PROJECTS

LESSONS LEARNED

Lesson ID: 01. Use ESPM resources (archive, faculty & alumni consultations)
Keywords: research, archive, UAA ESPM
Knowledge Areas Impacted: Scope management, Integration management
Document Impacted: Project Charter
Project Process Category: Integration
Lesson Learned Summary: Prior to enrolling into PM686A, the PM became familiar with the content of the ESPM capstone projects & theses archive.
Recommendations: Not being familiar and comfortable with PM686 expectations may result in prolonged project delivery, difficulties with determining capstone project scope, requirements, etc. Reading through former capstone project documentation and watching defense presentations helps navigate through capstone requirements, provides examples of topics, formatting and structure of papers and projects. Result: the student is better prepared for PM686 sequence workload and requirements. Gain access to capstone projects digital archive as soon as possible and become familiar with available content to understand PM686 structure and format. Consult with all ESPM faculty on examples of topics, potential ideas and experience. Network with alumni or current PM686 students to gauge their opinions and advice. Become familiar with course requirements, the sequence and nature of major deliverables (i.e. IRB proposal submittal, PPMs).

Lesson ID: 02. Develop topic and determine feasibility as soon as possible
Keywords: feasibility, scope
Knowledge Areas Impacted: scope management, integration management
Document Impacted: Project Charter
Project Process Category: Integration
Lesson Learned Summary: The capstone project topic, sponsor, committee members and major requirements were determined prior to starting PM686A which allowed for more time to be dedicated to the planning process.
Recommendations: Not having a semi-defined topic before the first PPM may delay project delivery, result in re-scoping and changes, and is overall troublesome. Starting PM686A with a topic that has been determined feasible mitigates potential for negative change. Start researching potential interest areas (industries, fields, PM knowledge areas, etc.) by addressing the needs of your organization, identifying gaps in the PM Body of Knowledge (via PMI resources), and consulting with faculty. Determine preliminary advisory board members, obtain project sponsorship and major research sources prior to enrolling in PM686A.

Lesson ID: 03. Allocate sufficient slack to take breaks from the creative process
Keywords: schedule
Knowledge Areas Impacted: time management
Document Impacted: project schedule, PMP
Project Process Category: Planning
Lesson Learned Summary: Project schedule had sufficient slack to allow for breaks between activities associated with the final report.
Recommendations: when developing the report, 'writing block' may happen if the writing process is undertaken under strict time constraints. Breaking up the process with sufficient time to let text or discussion points mature may help create fresh new ideas and outlook. If possible, allocate buffer time in between

writing activities, or prior to submittal of the first draft to review the text after a pause (4 days to a week) and let the written report 'mature' in its content.

Lesson ID: 04. Allow room for uncertainty and be open to change
Keywords: uncertainty, risk, opportunity, change
Knowledge Areas Impacted: scope management, change management, risk management
Document Impacted: PMP
Project Process Category: Planning
Lesson Learned Summary: The PM and committee members understood the value behind scope change in case opportunities arose to pursue a different path in the research process.
Recommendation: Research projects are inherently risky. Allowing room for changes in scope may result in: findings of a different nature, more findings, new approaches to describing findings, different type of research altogether. Data may suggest findings that support a different hypothesis or suggest a completely different topic. Understand that uncertainty also creates opportunities in addition to risk, be flexible in your approach and make sure that your risk and change management plans reflect that.

RISK ENVIRONMENT IN NORTHERN SEA ROUTE TRANSPORTATION PROJECTS

KNOWLEDGE AREA APPLICATION

KNOWLEDGE AREA FOCUS AND APPLICATION

SCOPE MANAGEMENT

Focus: Change Control

Objective: to capture and analyze scope changes; find root causes and determine factors contributing to the project environment (known unknowns, risk triggers, opportunities). During closeout, produce lessons learned specific to knowledge area.

Measuring Application: a change control process was used to capture change and identify deviations from original project specifics. An opportunity was taken with change in advisory board which was a known unknown and benefitted the project process greatly: new SMEs, data and guidance. Risks were also identified and occurrence logged. A narrative description of change logged the decisions behind change management.

Lessons Learned: keeping track of changes and logging the reasons behind decision-making in a narrative allowed for a complete and thorough understanding of the processes affecting scope. Most importantly it reaffirmed that the risk management plan accounted for all the necessary mitigation and contingency measures.

Tools used:

Change Control Log							
Project	Risk Environment in Northern Sea Route Transportation Project				**Sponsor**	Institute of the North	
Project Manager	Lena Petrova				**Updated**	10/26/2014	
ID	**Change Description**	**Priority**	**Originator**	**Date Entered**	**Date Assigned**	**Status**	**Date of Decision**
1	New advisory board member	High	LP	7/22/2014	7/23/2014	Approved	8/26/2014
2	Summarized categories of findings into 5 instead of original 6	High	LP	10/23/14	10/24/2014	Approved	10/26/2014

Description of Change			
Project	Risk Environment in Northern Sea Route Transportation Project	**Sponsor**	Institute of the North
Project Manager	Lena Petrova	**Updated**	10/26/2014
)	**Change**		

1	Sponsor/Adviser Nils Andreassen will now serve as Project Sponsor, and Dr. Brigham will be added to the advisory board providing guidance and support to the PM. First contacted as a SME, Dr. Brigham proved to be a valuable member of the internal project team, thus a change order was necessary.
2	The root causes of the 'health and safety' factor category related to 'environmental' factors, therefore it was necessary to list it under 'environmental'. Now there are 5 source categories of risk factors instead of 6.

Risk Realization Log						
Project	Risk Environment in Northern Sea Route Transportation Project				Sponsor	Institute of the North
Project Manager	Lena Petrova				Updated	10/26/2014
ID	Date	Risk	Trigger	Known/Unknown	Impact	Scope Change
1	3/24/2014	Receive unexpected support from stakeholders: new contacts, additional information and opportunities.	NA	Known	SME, Dr. Lawson Brigham, will provide additional support as unofficial adviser. New contacts and possible publishing opportunities captured.	NA
2	7/14/2014	Potential SME declined interview request	Email request	Known	SME kindly declined permission to be interviewed due to a busy navigational season. No impact.	NA
3	7/31/2014	Potential SME did not respond 2 weeks after initial request	Email request	Known	SME did not respond to email request.	NA

COMMUNICATIONS MANAGEMENT

Focus: Interview Management

Objective: to effectively manage communication with stakeholders and interviews with SMEs despite geographical constraints and the lack of buy-in. To produce a set of lessons learned reflecting on communicational challenges encountered.

Measuring Application: a narrative description of the interview processes will be completed during execution to reflect on communication challenges encountered, and to capture lessons learned pertaining to effective communication with interviewees in a constrained environment:

The most challenging communication activities were associated with the interviews conducted using different modes such as telephone interviews, personal meetings, emails requests, etc. Gaining access to a small community of professionals involved in Arctic marine transportation could not have happened, have an opportunity to collaborate with a new advisory committee member not presented itself. With the help of Dr. Brigham, gaining buy-in and support from SME's, as well as additional references was made possible.

Lessons learned: casting a broad net of inquiries and interview requests, contacting a larger variety of individuals, and organizations helped build a much larger pool of data than originally expected. Interviewees were not only respondents to the research material, but also providers of important background information having introduced the PM to the maritime industry and community with great enthusiasm.

Tools Used:

Communication Plan						
Project		Risk Environment in Northern Sea Route Transportation Projects		**Sponsor**		Institute of the North
Project manager		Lena Petrova		**Updated**		3/3/2014
ID	**Communication**	**Description**	**Frequency**	**Format**	**Recipient/ Attendees**	**WBS**
1	Internal Status Reports	Internal status reports for the advisory board	Once in three weeks	Dashboard, 3 minute briefing	LuAnn Piccard, Roger Hull, PM686 students	1.1.10, 1.1.22, 1.1.36
2	External Status Reports	Overall project progress and consultations with Sponsor	Once in three weeks	Email	Dr. Lawson Brigham, Nils Andreassen	1.1.10, 1.1.23, 1.2.1.4
3	Consultations with advisory board	Consultations to support the project progress, clarify academic requirements, discussion of best practices	Once every two weeks	Meetings	LuAnn Piccard, Roger Hull	1.1.14, 1.1.23
4	Interviews	Interviews with SMEs	As needed	Email, phone calls, video conference	SMEs	1.2.1

STAKEHOLDER MANAGEMENT

Focus: Identification

Objective: to perform stakeholder identification using the Circle Methodology, and extract lessons learned pertaining to effective stakeholder management.

Measuring Application: a final report on identified stakeholders will be provided as part of lessons learned. It will reflect changes to the stakeholder community and the decisions made during stakeholder assessment.

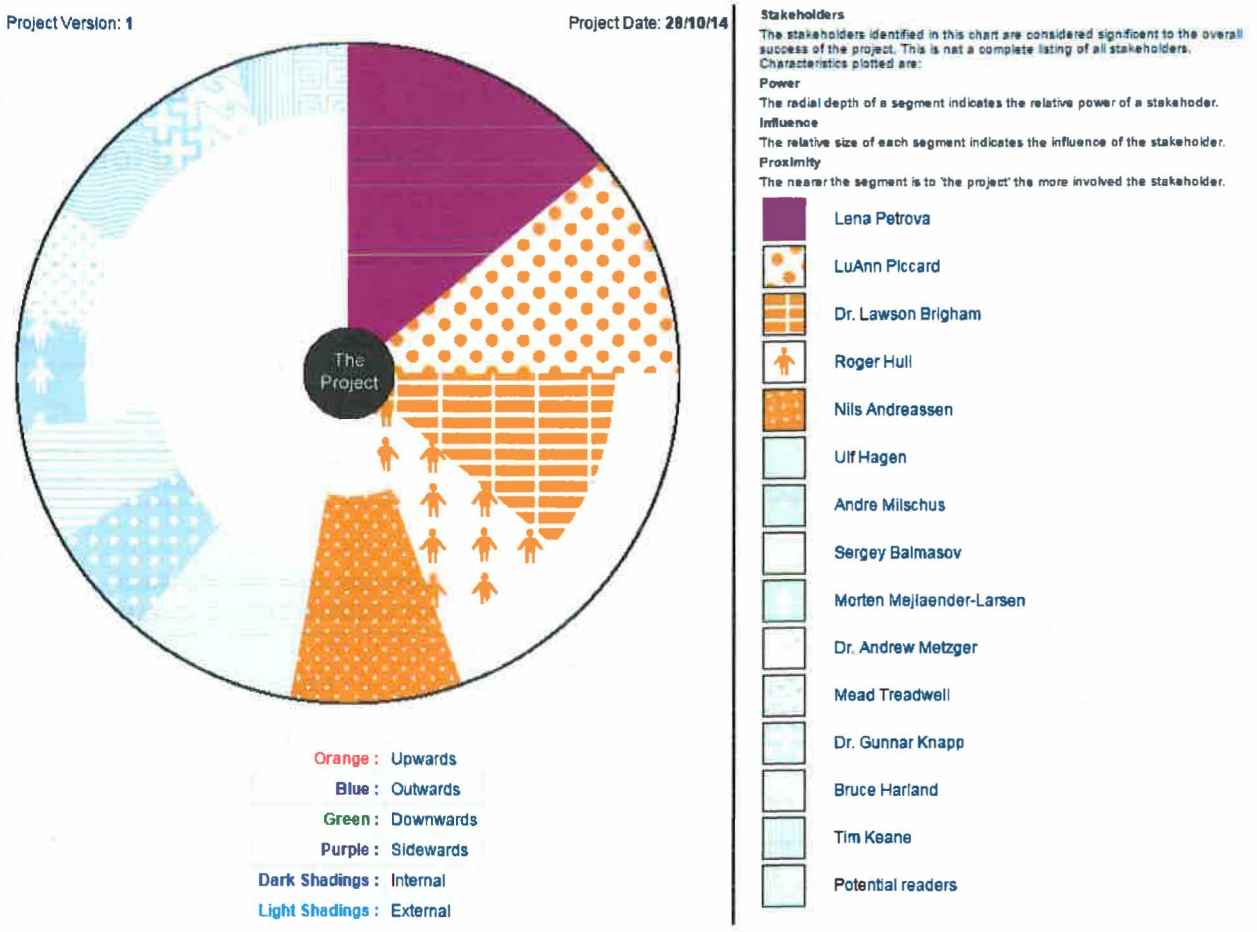
Final Stakeholder Report:
Committee and sponsorship agreements were established in the initiation phase. External stakeholders were identified through available literature and official transit statistics. Most external stakeholders are SMEs with experience in Arctic shipping. The next step was to acquire their permissions to interview. Roughly a third of all SMEs contacted with recruitment requests either did not reply or declined being interviewed. During execution, the stakeholder pool went through significant changes. Many initially identified stakeholders were determined unrelated to the project (most of them were potential SMEs that did not have the necessary experience to be interviewed) and were therefore excluded. During execution it was determined that an external SMEs indicated interest in becoming an advisory board member and his proximity, as well as engagement level were formally captured in the PMP. This change was of great benefit to the project. After

finishing the first round of interviews, SMEs were evaluated again. Only those with direct experience in NSR transportation were asked to complete the survey. The final stakeholder pool is presented below. Research findings showed that the interviewed SMEs provided consistent and valuable data, which suggests that stakeholder selection throughout the project was performed correctly.

Lessons learned: regular communication with internal and external stakeholders allowed for developing buy-in and engagement in the project, and allowed for opportunities to arise. The level of involvement in the project was not expected to change for external stakeholders, but it did once when an external SME became an advisory committee member.

Tools used:

Stakeholder Circle



Stakeholder Register

Step 1: Identify										Step 2: Prioritize				
List of Stakeholders			Identifying Mutuality				Categorize			Stakeholder Prioritization				
												Urgency		
Name	Stakeholder Organization	Role	Importance	Expectations	Potential Influence	Lifecycle Phase with Most Interest	Direction of Influence (U/D/O/S)	Internal/ External	Supporter/ Neutral/ Resistant	Power (1-4)	Proximity (1-4)	Value (1-5)	Action (1-5)	Ranking Score
Lena Petrova	PM Department	Author, student	PM	Fulfillment of academic requirements per coursework, project success	Project success or failure	Planning, Execution, Closing	N/A	I	Supporter	4	4	5	5	18
LuAnn Piccard	PM Department	Associate professor, ESPM Director	Primary Adviser	Fulfillment of academic requirements per coursework, project success	Go/No-Go Decision	Planning, Execution, Closing	U	I	Supporter	4	4	5	5	18
Dr. Lawson Brigham	UAF, Institute of North	Professor, Senior Fellow	Adviser	Final report and findings	May or may not share valuable information	Planning, Execution, Closing	U	I	Supporter	4	4	5	5	18
Roger Hull	PM Department	Associate professor	Adviser	Fulfillment of academic requirements per coursework, project success	Go/No-Go Decision	Planning, Execution, Closing	U	I	Supporter	4	4	5	5	18
Nils Andreassen	Institue of the North	Managing Director	Sponsor	Project success, final report and findings	Go/No-Go Decision	Closing	U	I	Supporter	4	2	5	4	15
Ulf Hagen	Tschudi Shipping Company	Managing Director	SME	Project success, final report and findings	Valuable source of info, SME contacts and references	Closing	O	E	Supporter	2	2	2	2	8
Andre Milschus	Hansa Heavy Lift GmbH	Head of EMEA	SME	Project success, final report and findings	Valuable source of info, SME contacts and references	Closing	O	E	Supporter	2	2	2	2	8
Sergey Balmasov	Center for High North Logistics	Head of the NSR Information Office	SME	Final report and findings	Valuable source of info, SME contacts and references	Closing	O	E	Neutral	2	1	2	2	7
Morten Mejlaender-Larsen	Det Norske Veritas GL-Maritime	Discipline Leader, Arctic Operation and Technology	SME	Final report and findings	Valuable source of info, SME contacts and references	Closing	O	E	Neutral	1	1	2	1	5
Dr. Andrew Metzger	UAA	Professor, Arctic researcher	SME	Final report and findings	Valuable source of info, SME contacts and references	Closing	O	E	Neutral	0	1	1	0	2
Mead Treadwell	State of Alaska	Lt. Governor, former USARC Chair	SME	Final report and findings	Valuable source of info, SME contacts and references	Closing	O	E	Supporter	0	1	1	0	2
Dr. Gunnar Knapp	ISER	Director	SME	Final report and findings	Valuable source of info, SME contacts and references	Closing	O	E	Neutral	0	1	1	0	2
Bruce Harland	Crowley	VP	SME	Final report and findings	Valuable source of info, SME contacts and references	Closing	O	E	Neutral	0	1	1	0	2
Tim Keane	FedNav	Operations Manager	SME	Final report and findings	Valuable source of info, SME contacts and references	Closing	O	E	Neutral	0	1	1	0	2
Potential readers	Public	Public	SME	Final report and findings	N/A	Closing	O	E	Neutral	0	1	1	0	2

PROJECT MANAGEMENT PLAN

RISK ENVIRONMENT IN NORTHERN SEA ROUTE TRANSPORTATION PROJECTS

LENA PETROVA
UNIVERSITY OF ALASKA ANCHORAGE 2014

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PROJECT DESCRIPTION

This risk identification and characterization project explores and defines risk factors affecting planning and execution of maritime transits along the Northern Sea Route. The risk factors were studied from the standpoint of a non-Russian shipping company planning a commercial transit through the Northern Sea Route from the west gates of the Kara Sea and its finish in the Bering Sea, respectively. The focus of this risk categorization project was not to discuss the economics and feasibility of shipping operations through the Northern Sea Route, but rather identify operational risk factors from a project management perspective. Transits through the NSR today justify the prudent implementation of a project environment, given the experimental nature of a large number of transits, and the uncertain conditions under which transits are planned and executed. As opposed to realized risks and hazards, risk factors are the root causes and circumstances that may or may not develop into risks. Every shipping project has its own unique challenges, but the nature of risks in this part of the Arctic offshore is constrained to a specific set of factors produced by a unique permutation of existing environmental, regulatory and economic conditions.

The findings formally address the following questions:

- What are the unique challenges of executing maritime transportation projects in this region?
- What risk factors are or should be addressed by shipping companies when planning a transit?
- What risk factors contribute to enhanced realism and adaptations in project scope, schedule and cost estimates?

The research was based primarily on interviews with experts on Arctic maritime transportation. Additional literature was reviewed with regard to project risk management practices, maritime shipping, the history of the Northern Sea Route and completed international transits. Findings are described by source and probability/impact category. A breakdown structure provides a summarized view of identified risk factors.

PROJECT SCOPE

To explore and define risk factors affecting maritime transportation projects in the Northern Sea Route region through studying past and future projects in the NSR, examining existing literature on the subject, interviewing subject matter experts, and summarizing findings in a twenty-page to thirty five-page research paper supplemented by a risk factor breakdown structure. Scope includes all project management work associated with planning, executing and closing the project, as well as designing interview questionnaires and briefing the final report in December 2014. The project is started on January 30, 2014 and is finished on December 8, 2014.

PROJECT DELIVERABLES

- Written report
- Risk factor breakdown structure

ASSUMPTIONS

- The results of this research are valid statements and contribute to the PM body of knowledge.
- The advisory board is available for consultations when needed.
- Subject matter experts agree to collaborate, and do so.
- Enough information is available for the PM to draw conclusions.

EXCLUSIONS

- The written report will only identify and discuss risk factors as opposed to risks and hazards.
- No human resources are assigned to this project besides the author.
- No funding is dedicated to this project.

CONSTRAINTS

- The project schedule is constrained by course deadlines.
- Project scope is chosen and may be enhanced through schedule crashing to compensate for schedule variances.
- A formal change control process will be utilized to support modifications to scope.
- Cost is accepted as no funding is dedicated to this project.
- Many stakeholders reside in geographically remote regions and will not be contacted in person. Some interviews will be conducted via other modes of communication (phone calls, email, video conference).

	Scope	Time	Cost
Fixed		☆	
Chosen	☆		
Adjustable			☆

CRITICAL SUCCESS FACTORS

- Deliverables are submitted on time
- Data collection and analysis is complete by October 1, 2014 and findings are summarized.
- Timely communication with advisory board
- Deliverables are approved by advisors and Sponsor

PRIMARY STAKEHOLDERS/POINTS OF CONTACT

Name	Role	Organization	Email
Lena Petrova	PM/Author	UAA MSPM	lypetrova@alaska.edu
Dr. Lawson Brigham	Adviser	UAF	lwb48@aol.com
Nils Andreassen	Project Sponsor	Institute of the North	nandreassen@institutenorth.org
LuAnn Piccard	Primary Adviser	UAA MSPM	lpiccard2@uaa.alaska.edu
Roger Hull	Adviser	UAA MSPM	rkhull@uaa.alaska.edu

SCOPE MANAGEMENT PLAN

A complete work breakdown structure is available in the Appendices. Changes to scope are requested by the PM, reviewed and approved by the advisory board, then implemented and logged as described in the Change Management Plan. The achievement of acceptance criteria is ensured by and described in the Quality Management Plan. Acceptance criteria specific for each project deliverable are introduced below.

OBJECTIVES

- To ensure deliverable acceptance
- To provide a detailed description of each project activity

DELIVERABLES ACCEPTANCE CRITERIA

Research Report	• 20-35 pages long, written according to academic standards • >90% positive feedback from advisory board and Sponsor • Findings are valid and contribute to the PM Body of Knowledge
Risk Factor Breakdown Structure	• Summarized findings illustrate risk factors in NSR maritime transportation projects • Findings contribute to the PM Body of Knowledge

WBS DICTIONARY

The WBS dictionary is included in the Appendices.

RISK MANAGEMENT PLAN

Risks for this project are identified and described below. Appropriate measures are developed with regard to uncertainty surrounding project scope and the dependence of project success on the occurrence of known unknowns.

OBJECTIVES

- To identify risks and opportunities that may potentially impact the success of the project
- To determine potential risk triggers, weight and impact of risks
- To develop mitigation and reaction strategies

RISK REGISTER

The risk register below provides information on risks applicable to this project and appropriate response & contingency measures. The register provides a weighted score for each risk according to the likeliness of occurrence and potential impact.

Risk Register

Project	Risk Environment in Northern Sea Route Transportation Projects		Sponsor	Institute of the North	
Project manager	Lena Petrova		Updated	2/26/2014	

ID	Risk Description	Probability	Impact	Detectability	Importance	Category	Trigger Event/Indicator	Mitigation	Response	Date Entered
1	SMEs refuse to collaborate	50%	4	3	12	Data; SMEs	Lack of responses from SMEs	Contact as many SMEs as possible	Draw conclusions on data available	2/13/2014
2	Data is uncertain	50%	4	3	12	Data	Data analysis suggests that interview feedback quality is poor, data source do not provide sufficient	Find and utilize as many sources as possible	Defer from initial topic, re-enroll in PM686A next semester, develop a different project	2/13/2014

							information			
3	Insufficient data	50%	4	3	12	Data	Data analysis suggests that collected information cannot support project progress.	Find and utilize as many sources as possible	Defer from initial topic, use topic #2, re-enroll in PM686A next semester, develop a different project	2/13/2014
4	Unable to reach SMEs	45%	3	3	8.1	Data; stakeholders	Stakeholders do not respond within 2 weeks from initial contact	Contact as many SMEs as possible	Consult with additional SMEs, advisers, draw conclusions on data available	2/26/2014
5	Receive unexpected support from stakeholders: new contacts, additional information and opportunities	30%	2	4	4.8	Data; stakeholders	Unknown	NA	Seize opportunity	2/26/2014
7	PM is sick or has an emergency	50%	1	2	2	PM	Unknown	Evaluate schedule for slack	Use slack or crash schedule	2/13/2014
8	Advisers not available for consultations	30%	1	2	1.2	Stakeholders	Advisers indicate inability to attend meetings	Plan meetings in accordance with stakeholders' schedules	Wait for advisers, crash schedule	2/13/2014
6	"No-go" decision received	15%	3	1	0.9	Project	Poor project performance as indicated in stakeholder feedback and academic progress	Consult with advisers regularly, systematically evaluate performance and take corrective action when necessary	Consult with advisers	2/26/2014

RISK REALIZATION LOG

A narrative description of risk occurrences will be produced upon each event. This will help during closeout analysis to improve scope and risk management capabilities.

Risk Realization Log			
Project	Risk Environment in Northern Sea Route Transportation Project	Sponsor	Institute of the North
Project Manager	Lena Petrova	Updated	10/26/2014

ID	Date	Risk	Trigger	Known/Unknown	Impact	Scope Change
1	3/24/2014	Receive unexpected support from stakeholders: new contacts, additional information and opportunities.	NA	Known	SME, Dr. Lawson Brigham, will provide additional support as unofficial adviser. New contacts and possible publishing opportunities captured.	NA
2	7/14/2014	Potential SME declined interview request	Email request	Known	SME kindly declined permission to be interviewed due to a busy navigational season. No impact.	NA
3	7/31/2014	Potential SME did not respond 2 weeks after initial request	Email request	Known	SME did not respond to email request.	NA

QUALITY MANAGEMENT PLAN

Success criteria and quality metrics are determined below. Achievement of these success criteria will be logged according to their completion status in the quality checklist provided in the closeout management plan. This will ensure adherence to target metrics and project quality.

OBJECTIVES

- To ensure achievement of critical success factors through analysis and planning.
- To develop project quality metrics and track progress against these metrics.
- To support best practices in project quality management.

PROJECT QUALITY METRICS

Achievement of critical success factors and adherence to quality metrics is ensured by and documented in the Closeout Management Plan upon project completion.

Project Quality Metrics			
Project	**Risk Environment In NSR Transportation Projects**	**Sponsor**	Institute of the North
PM	**Lena Petrova**	**Updated**	3/11/2014

ID	Critical Success Factors	Potential Quality Metric	Priority
1	Deliverables submitted on time	Finish date variance equals zero for every task associated with completing a deliverable	High
2	Data collection and analysis is complete by October 1, 2014 and findings are summarized.	Finish date variance equals zero for WBS 1.2.1, 1.2.2, 1.2.3	High

3	Timely communication with advisory board	Finish date variance equals zero for WBS 1.1.17, 1.1.23	High
4	Deliverables are approved by advisers and Sponsor	"Go" decision upon decision gate	High

SCHEDULE MANAGEMENT PLAN

OBJECTIVES

- Define the approach for effective time management from planning to delivery.
- Define the project's scheduling procedures and tools used to facilitate time management.
- Define how the project schedule is established, monitored, and maintained.

MILESTONE SCHEDULE

Project Milestone	Date
Project Start	01/30/2014
PPM1 Submitted	01/31/2014
PPM2 Submitted	02/21/2014
PPM3 Submitted	03/14/2014
IRB Submittal	03/28/2014
PPM4 Submitted/IRB Approval Received	04/11/2014
Go/No-Go Received	04/16/2014
Planning Complete	04/28/2014
PPM1 Submitted	09/19/2014
PPM2 Submitted	10/10/2014
Go/No-Go Received	10/15/2014
Execution Complete	10/23/2014
PPM3 Submitted	11/07/2014
Go/No-Go Received	11/12/2014
PPM4 Submitted	11/21/2014
Go/No-Go Received	11/26/2014
Project Complete	12/08/2014

SCHEDULE MONITORING

The PM will monitor and evaluate the schedule throughout the project lifecycle to identify the following:

- Schedule slippage
- Issues that may adversely affect the schedule
- Trends leading to possible slippage
- Milestone completion

SCHEDULE MODIFICATIONS

Routine schedule modifications are the PM's responsibility. In case of schedule variance, the PM will crash project activities as necessary. Modifications concerning critical project deadlines are subject to review by the project advisory board and implementation through a formal change control process.

PROJECT SCHEDULE

The project Gantt chart is provided in the Appendices.

CHANGE MANAGEMENT PLAN

OBJECTIVES

- To provide a standardized process for initiating, implementing and controlling change.
- To ensure changes are communicated to stakeholders.
- To provide a history of change and a narrative description of change decisions

CHANGE MANAGEMENT PROCESS

Significant changes to project scope such as change of topic, change in advisory board, critical reactions to high-level risks or critical decisions regarding compliance to the schedule baseline (deferring, i.e.) will be implemented through a formal change control process. Other low-level changes such as restructuring of the PMP and routine schedule modifications fall under the PM's authority to initiate and implement. Changes are logged and described in detail in a narrative which will serve as lessons learned during closeout

CHANGE LOG

Changes are to be documented in the change log below.

Change Control Log							
Project	Risk Environment in Northern Sea Route Transportation Project				**Sponsor**	Institute of the North	
Project Manager	Lena Petrova				**Updated**	10/26/2014	
ID	**Change Description**	**Priority**	**Originator**	**Date Entered**	**Date Assigned**	**Status**	**Date of Decision**
1	New advisory board member	High	LP	7/22/2014	7/23/2014	Approved	8/26/2014
2	Summarized categories of findings into 5 instead of original 6	High	LP	10/23/14	10/24/2014	Approved	10/26/2014

NARRATIVE DESCRIPTION OF CHANGE

Description of Change			
Project	Risk Environment in Northern Sea Route Transportation Project	**Sponsor**	Institute of the North
Project Manager	Lena Petrova	**Updated**	10/26/2014
ID	**Change**		
1	Sponsor/Adviser Nils Andreassen will now serve as Project Sponsor, and Dr. Brigham will be added to the		

	advisory board providing guidance and support to the PM. First contacted as a SME, Dr. Brigham proved to be a valuable member of the internal project team, thus a change order was necessary.
2	The root causes of the 'health and safety' factor category related to 'environmental' factors, therefore it was necessary to list it under 'environmental'. Now there are 5 source categories of risk factors instead of 6.

COST MANAGEMENT PLAN

No funding is dedicated to this project, as no expenses were determined necessary.

PROCUREMENT MANAGEMENT PLAN

No procurements were determined necessary for this project.

COMMUNICATIONS MANAGEMENT PLAN

OBJECTIVES

- To ensure that project information is systematically communicated to stakeholders
- To support positive relationships with stakeholders and ensure compliance with stakeholder requirements
- To describe the interview management approach

COMMUNICATIONS MATRIX

Communication Plan

Project	Risk Environment in Northern Sea Route Transportation Projects	**Sponsor**		Institute of the North
Project manager	Lena Petrova	**Updated**		3/3/2014

ID	Communication	Description	Frequency	Format	Recipient/ Attendees	WBS
1	Internal Status Reports	Internal status reports for the advisory board	Once in three weeks	Dashboard, 3 minute briefing	LuAnn Piccard, Roger Hull, PM686 students	1.1.10, 1.1.22, 1.1.36
2	External Status Reports	Overall project progress and consultations with Sponsor	Once in three weeks	Email	Dr. Lawson Brigham, Nils Andreassen	1.1.10, 1.1.23, 1.2.1.4
3	Consultations with advisory board	Consultations to support the project progress, clarify academic requirements, discussion of best practices	Once every two weeks	Meetings	LuAnn Piccard, Roger Hull	1.1.14, 1.1.23

Interviews	Interviews with SMEs	As needed	Email, phone calls, video conference	SMEs	1.2.1

STAKEHOLDER MANAGEMENT PLAN

Achievement of stakeholder management objectives is supported by tasks linked to requirements in the Requirements Traceability Matrix. Adherence to acceptance criteria is ensured through the completion of aforementioned tasks and is formally documented during closeout in the requirements checklist. Potential variance or failure analysis will be part of lessons learned.

OBJECTIVES

- To ensure stakeholder involvement and cooperation.
- To ensure stakeholder interests and requirements are met.

REGISTER

The full stakeholder register is included in the Appendices.

INTERNAL STRUCTURE

POWER/INTEREST GRID

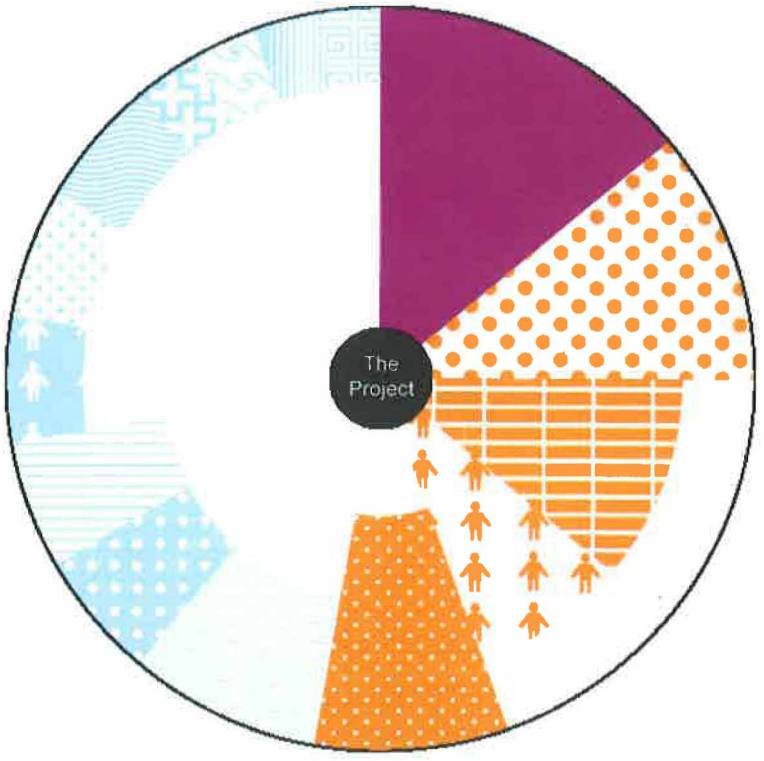
High Power Low Interest	High Power High Interest
• Sergey Balmasov • Morten Mejlaender-Larsen	• LuAnn Piccard • Roger Hull • Nils Andreassen • Dr. Lawson Brigham • Ulf Hagen • Andre Milschus

Low Power Low Interest	Low Power High Interest
• Mead Treadwell • Dr. Gunnar Knapp • Bruce Harland • Tim Keane	• Potential readers/public • Dr. Andrew Metzger

STAKEHOLDER CIRCLE

Project Version: **1**

Project Date: **28/10/14**



Orange : Upwards
Blue : Outwards
Green : Downwards
Purple : Sidewards
Dark Shadings : Internal
Light Shadings : External

Stakeholders
The stakeholders identified in this chart are considered significant to the overall success of the project. This is not a complete listing of all stakeholders.
Characteristics plotted are:

Power
The radial depth of a segment indicates the relative power of a stakeholder.

Influence
The relative size of each segment indicates the influence of the stakeholder.

Proximity
The nearer the segment is to 'the project' the more involved the stakeholder.

- Lena Petrova
- LuAnn Piccard
- Dr. Lawson Brigham
- Roger Hull
- Nils Andreassen
- Ulf Hagen
- Andre Milschus
- Sergey Balmasov
- Morten Mejlaender-Larsen
- Dr. Andrew Metzger
- Mead Treadwell
- Dr. Gunnar Knapp
- Bruce Harland
- Tim Keane
- Potential readers

REQUIREMENTS TRACEABILITY MATRIX

Achievement of requirements is ensured by and documented in the Closeout Management Plan.

REQUIREMENTS TRACEABILITY MATRIX				
Project Name:	**Risk Environment In NRS Transportation Projects**		**Sponsor**	Institute of the North
PM:	Lena Petrova		**Updated**	10/9/14
ID	***Requirement***	***Acceptance Criteria***	***Source***	**WBS Element**
001	Paper format	>20 pages long, formatted according to PMI Global Congress standards	UAA MSPM	1.2.3

92	Draft quality	Review deliverables with advisers and receive feedback	Advisory Committee	1.2.3
003	Final deliverables quality	>90% final grade	UAA MSPM	1.3.18
004	On time submission of deliverables	>90% PPM grades	UAA MSPM	1.3.18
005	Study the risk environment in the NSR region	RBS and final report	Sponsor	1.2.1, 1.2.2
006	Perform literature search	Diverse and reliable sources	Sponsor	1.2.2
007	Original interview tools	Develop and use original questionnaires to conduct interviews with SMEs	UAA MSPM	1.2.1
008	Narrative description of findings	Write research paper that describes NSR risks in a narrative	Sponsor	1.2.3
009	Risk breakdown structure	Summarize findings in a RBS	Sponsor	1.2.3
010	Final presentation	Present findings in December 2014	UAA MSPM	1.3
011	Data collection is executed according to academic standards.	Academic requirements are imposed to ensure product quality. IRB certification and approval of interview protocols are required to start execution.	UAA MSPM	1.2.1, 1.2.2
012	Deliverables are approved by advisers and Sponsor.	"Go/No-go" decisions are received upon decision gates. This is a critical stage gate review that will directly affect project progress.	UAA MSPM	1.3.4
013	Report findings contribute to the PM Body of Knowledge	The project needs to contribute to the PM Body of Knowledge, provide potentially useful and meaningful information	UAA MSPM	1.3

KNOWLEDGE AREA FOCUS AND APPLICATION

SCOPE MANAGEMENT

Focus: Change Control

Objective: To capture and analyze scope changes; find root causes and determine factors contributing to the project environment (known unknowns, risk triggers, opportunities). During closeout, produce lessons learned specific to knowledge area.

Description: In the process of planning, scope is defined with a degree of uncertainty that reflects the project environment. The PM will discover more requirements and enhance scope as the project progresses through a change control process. A narrative description of change will provide a commentary on the decisions made throughout the project which will serve as a basis for deriving lessons learned in the closeout phase. A set of known unknowns is identified early in the project and impact estimates are developed. A risk realization log will track risk occurrences and capture valuable information about these risks to provide a basis for lessons learned. Change control in this project is not only used from a standpoint of negative risk mitigation, but also from a standpoint of maximizing potential benefits from opportunities. If an opportunity presents itself and it has been determined that it can significantly enhance project success, scope will be changed independent of the degree of impact. Successful application of change control processes will be measured through the change log and the risk realization log to analyze how scope changed throughout the project lifecycle and how far the final project scope is related to the initial definition.

Measuring Application: Changes to scope reflect important decisions made during project execution and the factors triggering these changes reflect the uncertainty of its risk environment. Success will be measured

through analyzing risk occurrences where actual risk impacts will be compared to initial estimates as change occurs. This will be done using the risk realization log (Risk Management Plan) and describing new developments in a narrative.

Tools used:

- Change control process
- Narrative description of change
- Risk realization log
- Lessons Learned

COMMUNICATIONS MANAGEMENT

Focus: Interview Management

Objective: To effectively manage communication with stakeholders and interviews with SMEs despite geographical constraints and the lack of buy-in. To produce a set of lessons learned reflecting on communicational challenges encountered.

Description: SMEs are found and contacted through references, internet searches, publications and conferences. Most are contacted through email. Interviews with subject matter experts represent the bulk of execution activities. Considerable risk is associated with these tasks, depending on any given SME's decision to collaborate, and also the quality and scope of interview responses. The first factor is a trigger event which will determine if the risk of collecting insufficient amounts of data (Risk #3) will occur. The second is a characteristic determining whether or not the risk of collecting data that appears to be uncertain (Risk #2) will occur. Risk mitigation and reaction strategies are discussed in the Risk Management Plan.

The following interview approach will be taken. Most of the identified SMEs are located outside of PM's reach, i.e. in Russia, Norway, Germany or other locations in Alaska. Interviews with these SMEs will be conducted depending on the individual's preference (Skype, phone calls, email or other). Potential interviewees will be assessed according to their level of expertise in the subject and their agreement/refusal to participate. After they have indicated agreement to participate, they will be contacted and the interview process will officially start. The interview questions will consist of two tiers. The initial pool of questions will be introduced in the first round and depending on the quality of responses, follow up questions will be sounded either immediately or after some time is given to implement necessary changes. The content of the follow-up pool of questions will vary to the extent necessary to reflect any changes prompted by the first round of responses. The second tier may or may not be necessary depending on the quality of responses from the first round. It represents a matrix where SMEs will be asked to assign weightings to factors according to impact and probability. This matrix is only offered to those respondents with direct operational or research experience in shipping along the route. Interview responses will be analyzed and risk factors will be grouped into qualitative categories and subcategories according to source or root-causes, and impact & probability. Depending on the responses from SMEs, more stakeholders will be continuously identified and contacted. Stakeholder attitudes and the success of the interview phase will be analyzed upon completion to develop lessons learned.

Measuring Application: a narrative description of the interview processes will be completed during execution to reflect on communication challenges encountered, and to capture lessons learned pertaining to effective communication with interviewees in a constrained environment.

Tools Used:

- Communication matrix
- Communication modes (TBD)
- Interview protocol
- Lessons Learned

STAKEHOLDER MANAGEMENT

Focus: Identification

Objective: To perform stakeholder identification using the Circle Methodology, and extract lessons learned pertaining to effective stakeholder management.

Description: Stakeholders are identified and analyzed using Lynda Bourne's Circle Methodology. The nature of the project suggests that stakeholder identification is not complete in the planning phase, and is in fact a continuous process. New SMEs will be added throughout the project lifecycle. The change in the stakeholder pool will be analyzed to reflect on decisions made in stakeholder choice, the development of stakeholder engagement during execution, and the overall change in the stakeholder environment. Stakeholders are the most important source of research information, and monitoring the stakeholder pool's evolvement is important to understanding the overall project environment.

Measuring Application: a final report on identified stakeholders will be provided as part of lessons learned. It will reflect on the changes in stakeholder proximity and involvement during project execution.

Tools Used:

- Stakeholder register
- Stakeholder circle
- Requirements Traceability Matrix
- Lessons Learned

CLOSEOUT MANAGEMENT PLAN

The following checklists are to be completed upon project closure to ensure compliance to quality requirements. Lessons learned will be derived from the results of knowledge area application, the narrative description of change, risk realization analysis and compliance to quality metrics.

OBJECTIVES

- To ensure proper completion of the project.
- To ensure project acceptance by Sponsor.
- To archive project documentation.
- To perform post-execution analysis and collect lessons learned.

CLOSEOUT ACTIVITIES

Tasks are to be completed in the following order:

1. Final presentation
2. Complete closeout checklists
3. Extract and document Lessons Learned
4. Sponsor signs closeout form
5. Prepare and submit final project deliverables
6. Project Complete (Milestone)

DELIVERABLES ACCEPTANCE CHECKLIST

Deliverable	Criteria	Status
Research Report	• 20-35 pages long, written according to academic standards • >90% positive feedback from advisory board and Sponsor • Findings are valid and contribute to the PM Body of Knowledge	Complete
Risk Breakdown Structure	• Summarized findings illustrate risks in NSR maritime transportation projects • Findings contribute to the PM Body of Knowledge	Complete

REQUIREMENTS ACCEPTANCE CRITERIA

Requirement	Acceptance Criteria	Source	Status
Paper format	>20 pages long, formatted according to PMI Global Congress standards	UAA MSPM	Complete
Draft quality	Review deliverables with advisers and receive feedback	Advisory Committee	Complete
Final deliverables quality	>90% final grade	UAA MSPM	Complete
On time submission of deliverables	>90% PPM grades	UAA MSPM	Complete
Study the risk environment in NRS region	RBS and final report	Sponsor	Complete
Perform literature search	Diverse and reliable sources	Sponsor	Complete
Original interview tools	Develop and use original questionnaires to conduct interviews with SMEs	UAA MSPM	Complete
Narrative description of findings	Write research paper that describes NSR risks in a narrative	Sponsor	Complete
Risk breakdown structure	Summarize findings in a RBS	Sponsor	Complete
Final presentation	Present findings in December 2014	UAA MSPM	Complete
Data collection is executed according to academic standards.	Academic requirements are imposed to ensure product quality. IRB certification and approval of interview protocols are required to start execution.	UAA MSPM	Complete
Deliverables are approved by advisers and Sponsor.	"Go/No-go" decisions are received upon decision gates. This is a critical stage gate review that will directly affect project progress.	UAA MSPM	Complete
Report findings contribute to the PM Body of Knowledge	The project needs to contribute to the PM Body of Knowledge, provide potentially useful and meaningful information	UAA MSPM	Complete

CRITICAL SUCCESS FACTORS ACHIEVEMENT

Factor	Measure	Status
Deliverables are submitted on time.	Finish date variance equals zero for every task associated with completing an academic/project deliverable	Complete
"Go" decisions are received upon decision gates.	"Go" decision	Complete

Timely communication with advisory board	Finish date variance equals zero for WBS 1.1.17, 1.1.23	Complete
Data collection and analysis is complete by October 1, 2014 and findings are summarized.	Finish date variance equals zero for WBS 1.2.1, 1.2.2, 1.2.3	Complete

LESSONS LEARNED

The following template will be used by the PM to extract and log lessons learned.

Lesson ID:
Keywords:
Knowledge Areas Impacted:
Document Impacted:
Project Process Category:
Lesson Learned Summary (Problem, Solution, Result):
Recommendations:

CLOSEOUT ACCEPTANCE

This document formally recognizes acceptance of project closure. The project is complete and deliverables are received. All activities associated with closeout are finished.

Approved by the Project Sponsor:

_____ Date: _____

Nils Andreassen

Director

Institute of the North

PMP REVISION HISTORY

Version	Date	Name	Description
1.0	3/14/2014	Lena Petrova	Initial draft complete
2.0	4/10/2014	Lena Petrova	Second draft complete
3.0	4/28/2014	Lena Petrova	Final draft complete
4.0	10/26/2014	Lena Petrova	Updated
5.0	12/07/2014	Lena Petrova	Final draft complete

PMP CHANGE LOG

Change #	Added	Excluded	Updated	Date
1	CSFs	Risk analysis as a deliverable	Scope statement, risk register, project description, knowledge areas, requirements	2/8/14
2			Risk register, requirements traceability matrix	2/15/14
3	Quality Mgt Plan		CSFs	2/24/14
4			Quality Mgt Plan, Risk Matrix, CSFs, schedule	2/26/14
5	WBS references to comm matrix, procurement mgt plan, cost mgt plan		Schedule, comm mgt plan, closeout plan, CSFs, requirements	3/3/14
6	WBS, Power/Interest Grid		KA application, WBS dictionary, comm mgt plan	3/11/2014
7			Risk realization log, KA application	4/10/2014
8			Schedule, stakeholder register, WBS dictionary	4/28/2014
9	Stakeholder Circle		Every section and item	10/26/2014
10			Closeout checklists	12/07/2014

AUTHORIZATION

Approved by the Project Sponsor:

_____ Date: _____

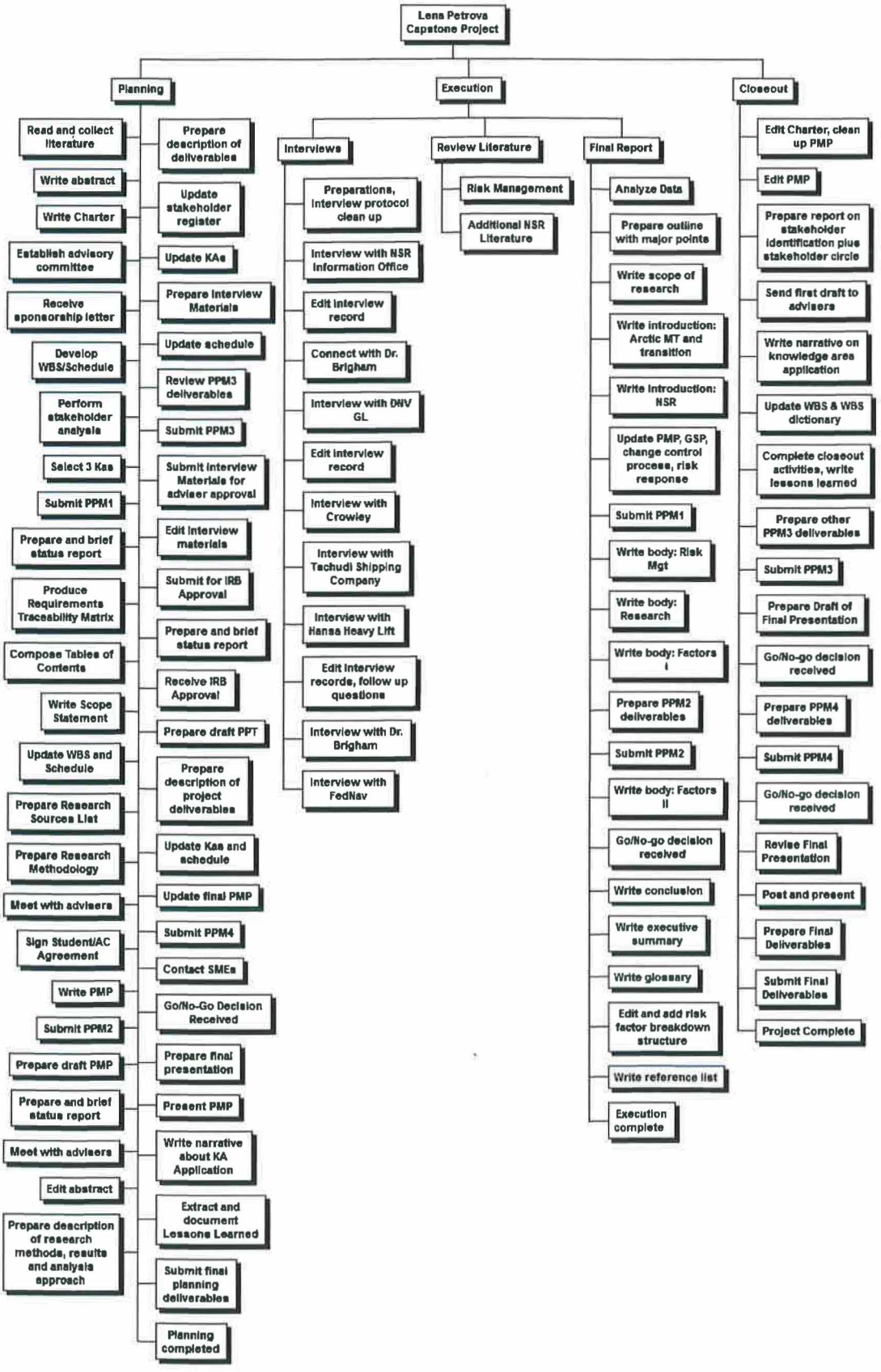
Nils Andreassen

Director

Institute of the North

APPENDICES

WBS



Work Breakdown Structure Dictionary						
Project		**Risk Environment in Northern Sea Route Transportation Projects**			**Sponsor**	**Institute of the North**
Project manager		**Lena Petrova**			**Updated**	**10/30/2014**
WBS ID	**Task**	**Description**	**Status**	**Duration**	**Start Date**	**Finish Date**
Lena Petrova Capstone Project			In Progress	**264 days**	**Thu 1/30/14**	**Mon 12/8/14**
1.1	**Planning**		Closed	**68.38 days**	**Thu 1/30/14**	**Mon 4/28/14**
1.1.1	Read and collect literature	Collect and study literature	Closed	224 hrs	Thu 1/30/14	Fri 3/7/14
1.1.2	Write abstract	Write preliminary abstract for research paper	Closed	2 hrs	Thu 1/30/14	Thu 1/30/14
1.1.3	Write Charter	Develop Project Charter, lay out project fundamentals	Closed	6 hrs	Thu 1/30/14	Thu 1/30/14
1.1.4	Establish advisory committee	Contact potential advisers, discuss project, develop agreements	Closed	1 hr	Thu 1/30/14	Thu 1/30/14
1.1.5	Receive sponsorship letter	Receive official letter of support from Project Sponsor	Closed	1 hr	Thu 1/30/14	Thu 1/30/14
1.1.6	Develop WBS/Schedule	Develop preliminiary tasks, sequence tasks, develop timelines and wbs	Closed	4 hrs	Thu 1/30/14	Thu 1/30/14
1.1.7	Perform stakeholder analysis	Identify project stakeholders, identify their importance and relationship to the project, identify requirements	Closed	3 hrs	Thu 1/30/14	Thu 1/30/14
1.1.8	Select 3 Kas	Identify and discuss 3 knowledge areas to be emphasized and performed upon during the project	Closed	2 hrs	Thu 1/30/14	Thu 1/30/14
1.1.9	Submit PPM1	Post deliverables on Blackboard	Closed	0 hrs	Thu 1/30/14	Thu 1/30/14
1.1.10	Prepare and brief status report	Communicate project status in class	Closed	1 hr	Fri 2/7/14	Fri 2/7/14
1.1.11	Produce Requirements Traceability Matrix	Trace requirements to WBS elements	Closed	2 hrs	Thu 2/13/14	Thu 2/13/14
1.1.12	Compose Tables of Contents	Develop contents to PMP and Research Paper	Closed	2 hrs	Thu 2/13/14	Thu 2/13/14
1.1.13	Write Scope Statement	Develop the scope statement	Closed	1 hr	Thu 2/13/14	Thu 2/13/14
1.1.14	Update WBS and Schedule	Update task completion, edit, clean up, etc.	Closed	2 hrs	Fri 2/14/14	Fri 2/14/14
1.1.15	Prepare Research Sources List	List research sources	Closed	3 hrs	Sat 2/15/14	Sat 2/15/14
1.1.16	Prepare Research Methodology	Discuss interview approach	Closed	4 hrs	Sat 2/15/14	Sat 2/15/14

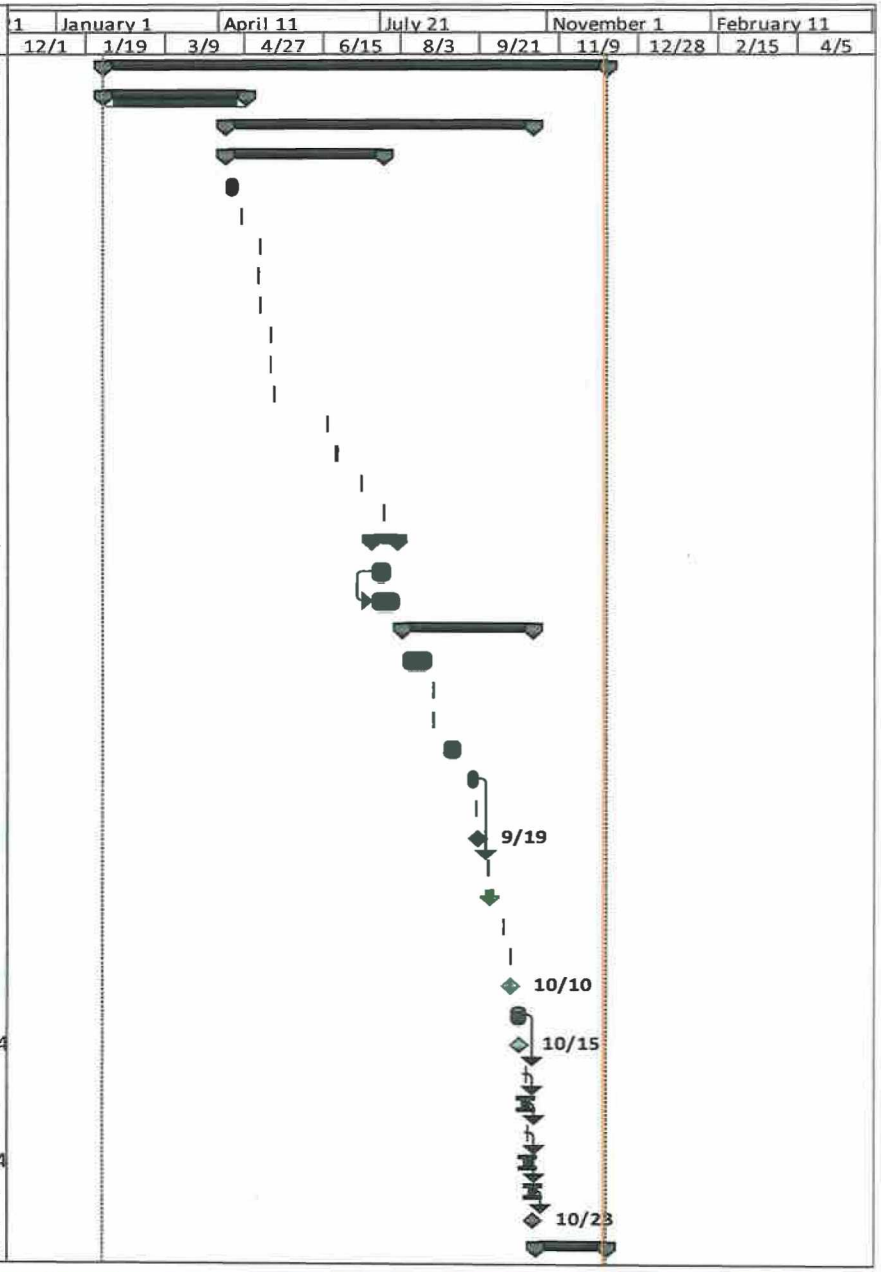
1.1.17	Meet with advisers	Meet with advisers	Closed	1 hr	Sun 2/16/14	Sun 2/16/14
1.1.18	Sign Student/AC Agreement	Receive signed agreement	Closed	8 hrs	Mon 2/17/14	Mon 2/17/14
1.1.19	Write PMP	Develop PMP	Closed	16 hrs	Tue 2/18/14	Wed 2/19/14
1.1.20	Submit PPM2	Post deliverables on Blackboard	Closed	0 hrs	Thu 2/20/14	Thu 2/20/14
1.1.21	Prepare draft PMP	Finish PMP	Closed	112 hrs	Mon 2/24/14	Thu 3/13/14
1.1.22	Prepare and brief status report	Communicate project status in class	Closed	1 hr	Fri 2/28/14	Fri 2/28/14
1.1.23	Meet with advisers	Meet with advisers	Closed	1 hr	Tue 3/4/14	Tue 3/4/14
1.1.24	Edit abstract	Revise and edit abstract	Closed	1 hr	Wed 3/5/14	Wed 3/5/14
1.1.25	Prepare description of research methods, results and analysis approach	Discuss research methodology	Closed	1 hr	Wed 3/5/14	Wed 3/5/14
1.1.26	Prepare description of deliverables	Discuss deliverables	Closed	1 hr	Wed 3/5/14	Wed 3/5/14
1.1.27	Update stakeholder register	Update list of stakeholders, revise and edit	Closed	6 hrs	Tue 3/11/14	Tue 3/11/14
1.1.28	Update KAs	Update knowledge area application	Closed	2 hrs	Tue 3/11/14	Tue 3/11/14
1.1.29	Prepare Interview Materials	Prepare interview protocol	Closed	32 hrs	Wed 3/12/14	Sun 3/16/14
1.1.30	Update schedule	Revise and update schedule	Closed	1 hr	Thu 3/13/14	Thu 3/13/14
1.1.31	Review PPM3 deliverables	Revise and update PPM3 deliverables	Closed	2 hrs	Thu 3/13/14	Thu 3/13/14
1.1.32	Submit PPM3	Post deliverables on Blackboard	Closed	0 days	Fri 3/14/14	Fri 3/14/14
1.1.33	Submit interview Materials for adviser approval	Present interview protocol to adviser, receive approval	Closed	24 hrs	Mon 3/17/14	Wed 3/19/14
1.1.34	Edit Interview materials	Review and update interview protocol	Closed	8 hrs	Thu 3/20/14	Thu 3/20/14
1.1.35	Submit for IRB Approval	Submit IRB proposal package	Closed	0.3 hrs	Wed 3/26/14	Wed 3/26/14
1.1.36	Prepare and brief status report	Communicate project status in class	Closed	1 hr	Fri 3/28/14	Fri 3/28/14
1.1.37	Receive IRB Approval	Receive approval	Closed	0 hrs	Mon 3/31/14	Mon 3/31/14
1.1.38	Prepare draft PPT	Develop presentation	Closed	3 hrs	Thu 4/10/14	Thu 4/10/14
1.1.39	Prepare description of project deliverables	Describe project deliverables	Closed	1 hr	Thu 4/10/14	Thu 4/10/14
1.1.40	Update Kas and schedule	Update Kas and schedule	Closed	1 hr	Thu 4/10/14	Thu 4/10/14
1.1.41	Update final PMP	Revise and update final project plan	Closed	2 hrs	Thu 4/10/14	Thu 4/10/14
1.1.42	Submit PPM4	Post deliverables on Blackboard	Closed	0 hrs	Fri 4/11/14	Fri 4/11/14
1.1.43	Contact SMEs	Start recruiting SMEs	Closed	3 hrs	Wed 4/16/14	Wed 4/16/14
1.1.44	Go/No-Go Decision Received	Receive decision	Closed	0 hrs	Wed 4/16/14	Wed 4/16/14
1.1.45	Prepare final presentation	Finish presentation	Closed	4 hrs	Mon 4/21/14	Mon 4/21/14
1.1.46	Present PMP	Present final plan	Closed	2 hrs	Tue 4/22/14	Tue 4/22/14
1.1.47	Write narrative about KA Application	Discuss KA application	Closed	4 hrs	Tue 4/22/14	Tue 4/22/14
1.1.48	Extract and document Lessons Learned	Document lessons learned	Closed	4 hrs	Wed 4/23/14	Wed 4/23/14
1.1.49	Submit final planning deliverables	Submit final plan package	Closed	3 hrs	Mon 4/28/14	Mon 4/28/14

1.1.50	Planning completed	Milestone	Closed	0 days	Mon 4/28/14	Mon 4/28/14
1.2	**Execution**		Closed	**158.5 days**	**Wed 4/16/14**	**Thu 10/23/14**
1.2.1	**Interviews**		Closed	**69.25 days**	**Wed 4/16/14**	**Tue 7/22/14**
1.2.1.1	Preparations, interview protocol clean up	Revise and edit protocol	Closed	4 days	Wed 4/16/14	Mon 4/21/14
1.2.1.2	Interview with NSR Information Office	Telephone interview and discussion	Closed	1 hr	Thu 4/24/14	Thu 4/24/14
1.2.1.3	Edit interview record	Review and clean up interview log	Closed	1 hr	Tue 5/6/14	Tue 5/6/14
1.2.1.4	Connect with Dr. Brigham	Telephone interview and discussion	Closed	1 hr	Mon 5/5/14	Mon 5/5/14
1.2.1.5	Interview with DNV GL	Telephone interview and discussion	Closed	1 hr	Tue 5/6/14	Tue 5/6/14
1.2.1.6	Edit interview record	Review and clean up interview log	Closed	1 hr	Mon 5/12/14	Mon 5/12/14
1.2.1.7	Interview with Crowley	Personal interview and discussion	Closed	1 hr	Mon 5/12/14	Mon 5/12/14
1.2.1.8	Interview with Tschudi Shipping Company	Telephone interview and discussion	Closed	1 hr	Wed 5/14/14	Wed 5/14/14
1.2.1.9	Interview with Hansa Heavy Lift	Personal interview and discussion	Closed	2 hrs	Tue 6/17/14	Tue 6/17/14
1.2.1.10	Edit interview records, follow up questions	Review and clean up interview logs, send second round of questions	Closed	4 hrs	Sun 6/22/14	Mon 6/23/14
1.2.1.11	Interview with Dr. Brigham	Personal interview and discussion	Closed	2 hrs	Tue 7/8/14	Tue 7/8/14
1.2.1.12	Interview with FedNav	Telephone interview and discussion; send second part	Closed	2 hrs	Tue 7/22/14	Tue 7/22/14
1.2.2	**Review Literature**		Closed	**12 days**	**Tue 7/15/14**	**Wed 7/30/14**
1.2.2.1	Risk Management	Find and study literature	Closed	9 days	Tue 7/15/14	Fri 7/25/14
1.2.2.2	Additional NSR Literature	Find and study literature	Closed	12 days	Tue 7/15/14	Wed 7/30/14
1.2.3	**Final Report**		Closed	**80.5 days**	**Mon 8/4/14**	**Thu 10/23/14**
1.2.3.1	Analyze Data	Compile risk factor matrix, analyze findings, review log data	Closed	17 days	Mon 8/4/14	Wed 8/20/14
1.2.3.2	Prepare outline with major points	Review and edit outline	Closed	4 hrs	Fri 8/22/14	Fri 8/22/14
1.2.3.3	Write scope of research	Develop scope of research	Closed	1 hr	Fri 8/22/14	Fri 8/22/14
1.2.3.4	Write introduction: Arctic MT and transition	Develop background information section	Closed	10 days	Fri 8/29/14	Sun 9/7/14
1.2.3.5	Write introduction: NSR	Develop background information section	Closed	6 days	Sat 9/13/14	Thu 9/18/14
1.2.3.6	Update PMP, GSP, change control process, risk response	Update plan elements	Closed	4 hrs	Wed 9/17/14	Wed 9/17/14
1.2.3.7	Submit PPM1	Post deliverables on Blackboard	Closed	0 hrs	Fri 9/19/14	Fri 9/19/14
1.2.3.8	Write body: Risk Mgt	Develop background information section	Closed	2 hrs	Thu 9/25/14	Thu 9/25/14
1.2.3.9	Write body: Research	Write about research methodology	Closed	3 hrs	Sat 9/27/14	Sat 9/27/14

1.2.3.10	Write body: Factors I	Write qualitative description of risk factors	Closed	8 hrs	Sun 10/5/14	Sun 10/5/14
1.2.3.11	Prepare PPM2 deliverables	Update PPM2 deliverables	Closed	1 day	Thu 10/9/14	Thu 10/9/14
1.2.3.12	Submit PPM2	Post deliverables on Blackboard	Closed	0 hrs	Fri 10/10/14	Fri 10/10/14
1.2.3.13	Write body: Factors II	Write quantitative description of risk factors	Closed	64 hrs	Fri 10/10/14	Fri 10/17/14
1.2.3.14	Go/No-go decision received	Receive decision	Closed	0 days	Wed 10/15/14	Wed 10/15/14
1.2.3.15	Write conclusion	Develop conclusion	Closed	8 hrs	Sat 10/18/14	Sat 10/18/14
1.2.3.16	Write executive summary	Write execution summary	Closed	1 hr	Sun 10/19/14	Sun 10/19/14
1.2.3.17	Write glossary	Write glossary	Closed	2 hrs	Sun 10/19/14	Sun 10/19/14
1.2.3.18	Edit and add risk factor breakdown structure	Edit appendices	Closed	0.3 hrs	Mon 10/20/14	Mon 10/20/14
1.2.3.19	Write reference list	Write references	Closed	4 hrs	Thu 10/23/14	Thu 10/23/14
1.2.3.20	Execution complete	Milestone	Closed	0 days	Thu 10/23/14	Thu 10/23/14
1.3	**Closeout**		Closed	**43 days**	**Sun 10/26/14**	**Mon 12/8/14**
1.3.1	Edit Charter, clean up PMP	Clean up charter and plan	Closed	4 hrs	Sun 10/26/14	Sun 10/26/14
1.3.2	Edit PMP	Edit PMP elements	Closed	2 hrs	Mon 10/27/14	Mon 10/27/14
1.3.3	Prepare report on stakeholder identification plus stakeholder circle	Develop stakeholder circle, edit other	Closed	4 hrs	Mon 10/27/14	Mon 10/27/14
1.3.4	Send first draft to advisers	Send first draft for review to advisers	Closed	0 hrs	Mon 10/27/14	Mon 10/27/14
1.3.5	Write narrative on knowledge area application	Write KA application report	Closed	2 hrs	Thu 10/30/14	Thu 10/30/14
1.3.6	Update WBS & WBS dictionary	Update and edit WBS, and WBS dictionary	Closed	1 hr	Thu 10/30/14	Thu 10/30/14
1.3.7	Complete closeout activities, write lessons learned	Complete closeout reporting, checklists, etc.	Closed	2 hrs	Thu 10/30/14	Fri 10/31/14
1.3.8	Prepare Draft of Final Presentation	Develop final presentation	Closed	3 hrs	Thu 11/6/14	Thu 11/6/14
1.3.9	Prepare other PPM3 deliverables	Update PPM3 deliverables	Closed	1 hr	Thu 11/6/14	Thu 11/6/14
1.3.10	Submit PPM3	Post deliverables on Blackboard	Closed	0 hrs	Fri 11/7/14	Fri 11/7/14
1.3.11	Go/No-go decision received	Receive decision	Closed	0 days	Wed 11/12/14	Wed 11/12/14
1.3.12	Prepare PPM4 deliverables	Update PPM4 deliverables	Closed	2 hrs	Thu 11/20/14	Thu 11/20/14
1.3.13	Submit PPM4	Post deliverables on Blackboard	Closed	0 hrs	Fri 11/21/14	Fri 11/21/14
1.3.14	Go/No-go decision received	Receive decision	Closed	0 days	Wed 11/26/14	Wed 11/26/14
1.3.15	Revise Final Presentation	Review and edit final presentation	Closed	3 hrs	Sat 11/29/14	Sat 11/29/14
1.3.16	Post and present	Present	Closed	1 hr	Mon 12/1/14	Mon 12/1/14
1.3.17	Prepare Final Deliverables	Prepare final package	Closed	4 hrs	Wed 12/3/14	Wed 12/3/14
1.3.18	Submit Final Deliverables	Submit final package	Closed	1 hr	Mon 12/8/14	Mon 12/8/14
1.3.19	Project Complete	Milestone	Closed	0 days	Mon 12/8/14	Mon 12/8/14

GANTT CHART

ID	Task Name	Duration	% Complete	Start	Finish
1	**1 Lena Petrova Capstone Project**	**264 days**	**100%**	**Thu 1/30/14**	**Mon 12/8/14**
2	**1.1 Planning**	**68.38 days**	**100%**	**Thu 1/30/14**	**Mon 4/28/14**
53	**1.2 Execution**	**158.5 days**	**100%**	**Wed 4/16/14**	**Thu 10/23/14**
54	**1.2.1 Interviews**	**69.25 days**	**100%**	**Wed 4/16/14**	**Tue 7/22/14**
55	1.2.1.1 Preparations, interview protocol clean up	4 days	100%	Wed 4/16/14	Mon 4/21/14
56	1.2.1.2 Interview with NSR Information Office	1 hr	100%	Thu 4/24/14	Thu 4/24/14
57	1.2.1.3 Edit interview record	1 hr	100%	Tue 5/6/14	Tue 5/6/14
58	1.2.1.4 Connect with Dr. Brigham	1 hr	100%	Mon 5/5/14	Mon 5/5/14
59	1.2.1.5 Interview with DNV GL	1 hr	100%	Tue 5/6/14	Tue 5/6/14
60	1.2.1.6 Edit interview record	1 hr	100%	Mon 5/12/14	Mon 5/12/14
61	1.2.1.7 Interview with Crowley	1 hr	100%	Mon 5/12/14	Mon 5/12/14
62	1.2.1.8 Interview with Tschudi Shipping Compan	1 hr	100%	Wed 5/14/14	Wed 5/14/14
63	1.2.1.9 Interview with Hansa Heavy Lift	2 hrs	100%	Tue 6/17/14	Tue 6/17/14
64	1.2.1.10 Edit interview records, follow up questi	4 hrs	100%	Sun 6/22/14	Mon 6/23/14
65	1.2.1.11 Interview with Dr. Brigham	2 hrs	100%	Tue 7/8/14	Tue 7/8/14
66	1.2.1.12 Interview with FedNav	2 hrs	100%	Tue 7/22/14	Tue 7/22/14
67	**1.2.2 Review Literature**	**12 days**	**100%**	**Tue 7/15/14**	**Wed 7/30/14**
68	1.2.2.1 Risk Management	9 days	100%	Tue 7/15/14	Fri 7/25/14
69	1.2.2.2 Additional NSR Literature	12 days	100%	Tue 7/15/14	Wed 7/30/14
70	**1.2.3 Final Report**	**80.5 days**	**100%**	**Mon 8/4/14**	**Thu 10/23/14**
71	1.2.3.1 Analyze Data	17 days	100%	Mon 8/4/14	Wed 8/20/14
72	1.2.3.2 Prepare outline with major points	4 hrs	100%	Fri 8/22/14	Fri 8/22/14
73	1.2.3.3 Write scope of research	1 hr	100%	Fri 8/22/14	Fri 8/22/14
74	1.2.3.4 Write introduction: Arctic MT and transiti	10 days	100%	Fri 8/29/14	Sun 9/7/14
75	1.2.3.5 Write introduction: NSR	6 days	100%	Sat 9/13/14	Thu 9/18/14
76	1.2.3.6 Update PMP, GSP, change control process	4 hrs	100%	Wed 9/17/14	Wed 9/17/14
77	1.2.3.7 Submit PPM1	0 hrs	100%	Fri 9/19/14	Fri 9/19/14
78	1.2.3.8 Write body: Risk Mgt	2 hrs	100%	Thu 9/25/14	Thu 9/25/14
79	1.2.3.9 Write body: Research	3 hrs	100%	Sat 9/27/14	Sat 9/27/14
80	1.2.3.10 Write body: Factors I	8 hrs	100%	Sun 10/5/14	Sun 10/5/14
81	1.2.3.11 Prepare PPM2 deliverables	1 day	100%	Thu 10/9/14	Thu 10/9/14
82	1.2.3.12 Submit PPM2	0 hrs	100%	Fri 10/10/14	Fri 10/10/14
83	1.2.3.13 Write body: Factors II	64 hrs	100%	Fri 10/10/14	Fri 10/17/14
84	1.2.3.14 Go/No-go decision received	0 days	100%	Wed 10/15/14	Wed 10/15/14
85	1.2.3.15 Write conclusion	8 hrs	100%	Sat 10/18/14	Sat 10/18/14
86	1.2.3.16 Write executive summary	1 hr	100%	Sun 10/19/14	Sun 10/19/14
87	1.2.3.17 Write glossary	2 hrs	100%	Sun 10/19/14	Sun 10/19/14
88	1.2.3.18 Edit and add risk factor breakdown struc	0.3 hrs	100%	Mon 10/20/14	Mon 10/20/14
89	1.2.3.19 Write reference list	4 hrs	100%	Thu 10/23/14	Thu 10/23/14
90	1.2.3.20 Execution complete	0 days	100%	Thu 10/23/14	Thu 10/23/14
91	**1.3 Closeout**	**43 days**	**100%**	**Sun 10/26/14**	**Mon 12/8/14**



STAKEHOLDER REGISTER

Step 1: Identify										Step 2: Prioritize				
List of Stakeholders			Identifying Mutuality				Categorize			Stakeholder Prioritization				
												Urgency		
Name	Stakeholder Organization	Role	Importance	Expectations	Potential Influence	Lifecycle Phase with Most Interest	Direction of Influence (U/D/O/S)	Internal/ External	Supporter/ Neutral/ Resistant	Power (1-4)	Proximity (1-4)	Value (1-5)	Action (1-5)	Ranking Score
Lena Petrova	PM Department	Author, student	PM	Fulfillment of academic requirements per coursework, project success	Project success or failure	Planning, Execution, Closing	N/A	I	Supporter	4	4	5	5	18
LuAnn Piccard	PM Department	Associate professor, ESPM Director	Primary Adviser	Fulfillment of academic requirements per coursework, project success	Go/No-Go Decision	Planning, Execution, Closing	U	I	Supporter	4	4	5	5	18
Dr. Lawson Brigham	UAF, Institute of North	Professor, Senior Fellow	Adviser	Final report and findings	May or may not share valuable information	Planning, Execution, Closing	U	I	Supporter	4	4	5	5	18
Roger Hull	PM Department	Associate professor	Adviser	Fulfillment of academic requirements per coursework, project success	Go/No-Go Decision	Planning, Execution, Closing	U	I	Supporter	4	4	5	5	18
Nils Andreassen	Institue of the North	Managing Director	Sponsor	Project success, final report and findings	Go/No-Go Decision	Closing	U	I	Supporter	4	2	5	4	15
Ulf Hagen	Tschudi Shipping Company	Managing Director	SME	Project success, final report and findings	Valuable source of info, SME contacts and references	Closing	O	E	Supporter	2	2	2	2	8
Andre Milschus	Hansa Heavy Lift GmbH	Head of EMEA	SME	Project success, final report and findings	Valuable source of info, SME contacts and references	Closing	O	E	Supporter	2	2	2	2	8
Sergey Balmasov	Center for High North Logistics	Head of the NSR Information Office	SME	Final report and findings	Valuable source of info, SME contacts and references	Closing	O	E	Neutral	2	1	2	2	7
Morten Mejlaender-Larsen	Det Norske Veritas GL-Maritime	Discipline Leader, Arctic Operation and Technology	SME	Final report and findings	Valuable source of info, SME contacts and references	Closing	O	E	Neutral	1	1	2	1	5
Dr. Andrew Metzger	UAA	Professor, Arctic researcher	SME	Final report and findings	Valuable source of info, SME contacts and references	Closing	O	E	Neutral	0	1	1	0	2
Mead Treadwell	State of Alaska	Lt. Governor, former USARC Chair	SME	Final report and findings	Valuable source of info, SME contacts and references	Closing	O	E	Supporter	0	1	1	0	2
Dr. Gunnar Knapp	ISER	Director	SME	Final report and findings	Valuable source of info, SME contacts and references	Closing	O	E	Neutral	0	1	1	0	2
Bruce Harland	Crowley	VP	SME	Final report and findings	Valuable source of info, SME contacts and references	Closing	O	E	Neutral	0	1	1	0	2
Tim Keane	FedNav	Operations Manager	SME	Final report and findings	Valuable source of info, SME contacts and references	Closing	O	E	Neutral	0	1	1	0	2
Potential readers	Public	Public	SME	Final report and findings	N/A	Closing	O	E	Neutral	0	1	1	0	2

RISK ENVIRONMENT IN NORTHERN SEA ROUTE TRANSPORTATION PROJECTS

PROJECT CHARTER

PROJECT DESCRIPTION

This risk identification and characterization project explores and defines risk factors affecting planning and execution of maritime transits along the Northern Sea Route. The risk factors were studied from the standpoint of a non-Russian shipping company planning a commercial transit through the Northern Sea Route from the west gates of the Kara Sea and its finish in the Bering Sea, respectively. The focus of this risk categorization project was not to discuss the economics and feasibility of shipping operations through the Northern Sea Route, but rather identify operational risk factors from a project management perspective. Transits through the NSR today justify the prudent implementation of a project environment, given the experimental nature of a large number of transits, and the uncertain conditions under which transits are planned and executed. As opposed to realized risks and hazards, risk factors are the root causes and circumstances that may or may not develop into risks. Every shipping project has its own unique challenges, but the nature of risks in this part of the Arctic offshore is constrained to a specific set of factors produced by a unique permutation of existing environmental, regulatory and economic conditions.

The findings formally address the following questions:

- What are the unique challenges of executing maritime transportation projects in this region?
- What risk factors are or should be addressed by shipping companies when planning a transit?
- What risk factors contribute to enhanced realism and adaptations in project scope, schedule and cost estimates?

The research was based primarily on interviews with experts on Arctic maritime transportation. Additional literature was reviewed with regard to project risk management practices, maritime shipping, the history of the Northern Sea Route and completed international transits. Findings are described by source and probability/impact category. A breakdown structure provides a summarized view of identified risk factors.

PROJECT SCOPE

- To explore and define the risk environment in maritime transportation in the Northern Sea Route region
- To study past and future projects in the NSR
- To perform a literature search and examine existing data on the subject
- To utilize surveying tools to gather empirical data from subject matter experts
- To summarize findings in a narrative description of the risk environment in the NSR
- To summarize findings in a risk factor breakdown structure
- To present the report and findings in December 2014

PROJECT DELIVERABLES

- Written report
- Risk factor breakdown structure

CONSTRAINTS

	Scope	Time	Cost
Fixed		☆	
Chosen	☆		
Adjustable			☆

The project schedule is constrained by course deadlines. Project scope is chosen and may be enhanced through schedule crashing to compensate for schedule variances. A formal change control process will be utilized. Cost is accepted as the project does not require funding for resources.

ASSUMPTIONS

- The results of this research are valid statements and contribute to the PM body of knowledge.
- The advisory board is available for consultations when needed.
- Subject matter experts agree to collaborate, and do so.
- Enough information is available to the PM to draw conclusions.

EXCLUSIONS

- The written report will only identify and discuss risk factors as opposed to risks or hazards
- The written report will not include recommendations
- No funding is dedicated to this project
- No human resources are assigned to this project besides the author

CRITICAL SUCCESS FACTORS

Factor	Success measure
Deliverables are submitted on time	Schedule milestones are achieved
Data sources and report findings are valid	Use of peer-reviewed and original informational resources or well-established information sources
Deliverables are approved by advisors	Positive feedback post-presentation

PRIMARY STAKEHOLDERS/POINTS OF CONTACT

Name	Role	Organization	Email
Lena Petrova	PM/Author	UAA MSPM	lypetrova@alaska.edu
Dr. Lawson Brigham	External Adviser	UAF	lwb48@aol.com
Nils Andreassen	Project Sponsor	Institute of the North	nandreassen@institutenorth.org
LuAnn Piccard	Internal Adviser	UAA MSPM	lpiccard2@uaa.alaska.edu
Roger Hull	Internal Adviser	UAA MSPM	rkhull@uaa.alaska.edu

REQUIREMENTS TRACEABILITY MATRIX

Requirement	Source	Description	Measurement
Paper format	UAA MSPM	Minimum 20 pages long, formatted to PMI Global Congress standards	Paper more than 20 pages long formatted according to PMI Global Congress standards
Systematic communication w. advisers	PM	As described in communications and stakeholder management plan	100% completion of scheduled communication tasks
Draft quality	Advisory Committee	Review deliverables with advisers prior to submittal	Receive feedback from advisers
Final deliverables quality	UAA MSPM	Final product meets academic success criteria	Final grade >90%
Time	UAA MSPM	Deliverables submitted on time	Grading >90%

PROJECT MILESTONE SCHEDULE

Project Milestone	Date
Project Start	01/30/2014
PPM1 Submitted	01/31/2014
PPM2 Submitted	02/21/2014
PPM3 Submitted	03/14/2014
IRB Submittal	03/28/2014
PPM4 Submitted/IRB Approval Received	04/11/2014
Go/No-Go Received	04/16/2014
Planning Complete	04/28/2014
PPM1 Submitted	09/19/2014
PPM2 Submitted	10/10/2014
Go/No-Go Received	10/15/2014
Execution Complete	10/23/2014
PPM3 Submitted	11/07/2014
Go/No-Go Received	11/12/2014
PPM4 Submitted	11/21/2014
Go/No-Go Received	11/26/2014
Project Complete	12/08/2014

PROJECT RISK MANAGEMENT

Risk	Mitigation	Response
There is not be enough data to draw conclusions	Perform feasibility analysis during the data collection phase	Draw conclusions on data available with a reduced level of confidence
Data is uncertain		Consult with SMEs and advisers
SMEs reject collaboration	Contact a minimum of (number TBD) SMEs	Draw conclusions on data available
Advisers are not available for consultation	Contact unofficial advisers	Consult with additional advisers

PM is sick or has an emergency	Enhance scope and crash schedule

KNOWLEDGE AREA FOCUS AND APPLICATION

Area	Focus	Application
Scope Management	Planning, Change Control	In the process of planning, scope is defined with a degree of uncertainty that reflects the project environment. The PM will discover more requirements and enhance scope as the project progresses through a change control process and critical chain scheduling. A narrative description of change will provide a commentary on the decisions made throughout the project which will serve as lessons learned.
Time Management	Controls	Critical chain scheduling will be applied to produce a robust schedule. Variances will be analyzed and addressed through a change control process. Crashing will be used to enhance scope. Changes will be logged as mentioned above.
Stakeholder Management	Communication and requirements identification	Stakeholders are identified and analyzed using Lynda Bourne's Circle Methodology. A systematic approach to communicating with project stakeholders is ensured through a communications plan with tasks included in the project schedule.

REVISION HISTORY

Version	Date	Name	Description
1.0	1/30/2014	Lena Petrova	Initial draft complete
2.0	2/9/2014	Lena Petrova	Edit
3.0	10/26/2014	Lena Petrova	Updated

AUTHORIZATION

Approved by the Project Sponsor:

_____ Date:_____

Nils Andreassen

Managing Director

Institute of the North

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January 22, 2014

University of Alaska Anchorage
Project Management Department
University Center, Rm 155
3901 Old Seward Highway
Anchorage, AK 99503

Attn: Interim Director of ESPM

Re: Sponsorship Letter for MSPM Graduate Capstone Project

Dear Ms. Piccard,

The Institute of the North supports Lena Petrova's effort in identifying and analyzing risks in Northern Sea Route Transportation Projects. The Institute's mission is to study the development of circumpolar regions and inform the public on Arctic issues. Our work involves a wide range of international stakeholders from private and public sectors many of whom conduct transportation projects in the Arctic.

Given the recent developments in the circumpolar project landscape, we are interested in learning about Lena's findings and hearing the final report.

Please do not hesitate to contact me with questions or concerns regarding Lena's final project.

Sincerely,

Nils Andreassen
Executive Director